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Santa Clara Valley Water District

PERMANENTE CREEK PLANNING STUDY

Located in Santa Clara County, CA

STRUCTURAL INTEGRITY STUDY

Supplement 1

Permanente Creek Levee Evaluation Report

LEVEE REPORT
1999029
FN 440
MATERIALS/FINAL RPT

PARIKH CONSULTANTS, INC.

Practicing in the Geosciences

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GEOTECHNICAL INVESTIGATION REPORT
PERMANENTE CREEK LEVEE EVALUATION
SANTA CLARA COUNTY, CALIFORNIA

For

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Job No. 99106.10

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GEOTECHNICAL ENGINEERING INVESTIGATION REPORT

PERMANENTE CREEK LEVEE EVALUATION PROJECT

SANTA CLARA COUNTY, CALIFORNIA

INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation performed for evaluating stability of the existing levees along Permanente Creek in the City of Mountain View, California. The Project Location Map, Plate 1, shows the location of the site.

This report presents our understanding of the project, existing site conditions, purpose and scope of investigation followed by description of field exploration, general geology at the site, seismicity, our interpretation of the subsurface and groundwater conditions, and our findings and discussions. The work presented in this report was performed in general accordance with our agreement with Biggs Cardosa Associates, Inc.

PURPOSE AND SCOPE

The purpose of this investigation was to evaluate the general soil conditions at the site, to determine their engineering properties, to evaluate the condition of the existing levees as per US Army Corps of Engineers guidelines, and to assist Santa Clara Valley Water District (SCVWD) in their certification with FEMA. A detailed scope of work is presented in our proposal to Biggs Cardosa Associates.

The scope of work for this investigation included review of readily available soils and geologic literature pertaining to the site; obtaining representative samples and logging soil materials encountered in twelve exploratory borings; laboratory testing of collected samples, engineering analysis of the field and laboratory data; and preparation of this report.

SITE CONDITIONS

The description of existing conditions at the project site presented in this section of the report is based on our field observations, topographic information provided to us by the Water District, and the available as-built plans. The project site includes the existing levees along Permanente Creek, between Route 101 (Approximate Sta. 38+50) and the Salt Ponds located at approximately Sta. 19+50 (see attached Site Plan, Plate 2). Except for the concrete lined channel near Route 101 and under the bridges, the creek banks are earth slopes which appear to be constructed by raising the old natural creek levees. The existing levees at the site were constructed sometimes in 1960s and have been subsequently modified at most locations. Majority of the modifications include, raising the levees, and backfilling behind the landward slopes of the levees.

The levee heights (measured from the bottom of the creek) generally increases from about 4 m (13 feet), near Route 101, to about 5.5 m (18 feet) towards the downstream-end of the project. The riverside slopes of the levees are inclined from 1V:1.5H (between about Sta. 27+00 to 38+60) to 1V:2H (downstream of Sta. 27+00). The landside slope of the levees have been considerably modified since 1960s. They have been partially or completely backfilled during construction of adjoining industrial parks, landfills, golf courses, etc. Based on our review of the as-built levee sections, shear keys are provided under the levees north of approximate Sta. 32+00 (downstream from Amphitheater Parkway). These keys are usually 2.5 m to 3 m (8 feet to 10 feet) deep and about 3 m wide. A 3.5 m to 4 m (11.5 feet to 13 feet) wide maintenance road has been constructed on top of the levees. The levee slopes are presently covered with sparse to dense vegetation including grass, shrubs, trees and pickel-weeds. Excessive settlements, slope failures, cracking, etc. were not observed within the levees. However, localized sloughing, erosion, etc. were observed at many locations.

GEOLOGY

The site is located along the northern margin of the Santa Clara Valley, approximately 3 km (1.9 miles) west of the San Francisco Bay. The general geology at the site and its vicinity was mainly studied from a 1:62500 scale geologic map of late cenozoic deposits compiled by Helley and Brabb (1971). A portion of this map showing the site and its vicinity is presented on Geologic Map, Plate 3. Based on the physical properties and relative age of the deposits, Helley and Brabb have mapped unconsolidated, cenozoic deposits at the site and its surroundings. The surficial geologic units in the site vicinity were deposited during Tertiary to Quaternary Periods. Relatively younger units, i.e. Interfluvial Basin Deposits (Qb), Fluvial Deposits (Qyfo), Young Alluvial Fan Deposits (Qyf) and Older Fan Deposits (Qof) which mainly consist of alluvial, marine and lacustrine deposits are mapped within open valley and narrow canyons. Stream bed deposits and alluvial aprons and fans of earlier period (Qof) mapped in the site vicinity grade baywards into the Merritt Sand (Qm) along the margin of the bay. The younger fan deposits are superimposed on the older fan systems and grade into the Older Bay muds (Qobm) of the San Francisco Bay along the bay margin.

On a regional basis, the native soils underlying the site chiefly consist of silts and clays deposited in a bay-margin environment. Specifically, at the project site, the native surficial deposits have been mapped as Holocene Interfluvial Basin Deposits (Qb) and Pleistocene Older San Francisco Bay Muds (Qobm). Helley and Brabb have described these units as follows:

> "INTER FLUVIAL BASIN DEPOSITS, Qb - Mainly organic rich clay and silty clay that locally contain modern fresh-water Gastropods and Palecypods."
>
> "OLDER SAN FRANCISCO BAY MUD, Qobm - semi consolidated organic-rich clay deposits; underlies younger San Francisco bay mud and young alluvial fan deposits; extending landward to maximum elevation of 10 feet above Mean Sea Level."

The native surficial deposits at the site are exposed in the creek bed. At other locations, they are generally covered by asphalt concrete or artificial fill.

The bedrock at depth in the project area is presumed to be the Franciscan Complex of the upper Jurassic to Cretaceous age. The bedrock in the area is believed to be overlain by more than 150 m (500 feet) thick deposits (Rogers and Williams, 1974) of Tertiary marine/non-marine sediments and by Pleistocene to Recent deposits.

FIELD EXPLORATION

Based on the plans provided, discussions with client, and readily available geologic and existing boring information from previous studies, twelve borings were drilled up to a depth of 12.7 m (41.5 feet) below the top of the levees. The attached Plate 2, Site Plan, shows the approximate locations of these borings.

The test borings were advanced with a truck-mounted drill rig using a 208-mm (8 inches) diameter hollow stem auger. Selected drive samples were obtained from the borings at various depths using a 64 mm (2.5 inches) I.D. Modified California Sampler or a 36 mm (1.375 inches) I.D. Standard Penetration Sampler. The sampler was driven into the subsurface soils under the impact of a 64 kg (140 lbs) hammer having a free fall of 76 cm (30 inches). The blow counts required to drive the sampler for the last 30 cm (12 inches) are presented on the Log of Test Borings, Appendix A. (When correlating standard penetration data, the blow counts for the Modified California Sampler can be taken as roughly twice that for the Standard Penetration Test in similar soils). Pocket penetration tests were also performed on clay samples during field investigation to evaluate their consistency. The soil samples obtained during drilling were visually classified in the field and then transported to our laboratory for further evaluation and testing. All the boreholes were grouted as per SCVWD guidelines.

Laboratory tests including moisture content, dry density, atterberg limits, sieve analysis, consolidation, unconfined compression, and triaxial (Consolidated Undrained test with pore pressure measurements) were performed on soil samples collected during field exploration to determine the physical and engineering properties of the subsurface soils. Test methods and test results are presented on plates attached in Appendix B. Laboratory test results for moisture content, dry density, sieve analysis, atterberg limits and unconfined compression tests are presented on the attached boring logs, Appendix A.

The description of the soils encountered and relevant boring information are presented on the boring logs, attached in Appendix A. The bore logs presented in Appendix A were prepared from the field logs which were edited after visual re-examination of the soil samples in the laboratory and results of classification tests on selected soil samples as indicated on the logs. The abrupt stratum changes shown on these logs may be gradual and relatively minor changes in soil types within a stratum may not be noted on the logs due to field limitations.

To supplement our study, we also made reference to geotechnical investigation reports prepared by Lowney Associates (dated 3/17/99). Relevant boring logs from this report are attached in Appendix D.

SOIL CONDITIONS

Based on the information obtained from our study of the available geotechnical information; and, data obtained from our exploratory borings and laboratory tests, the site is generally underlain by levee fills overlying native alluvial/marine deposits predominantly consisting of clays.

Fills, used to construct the flood control levees were encountered in the borings. These fills extend to depths of about 4 m to 9 m (13 feet to 29.5 feet) (where shear keys are provided) below the top of the levees. The fills appear to be well compacted. The fill material is generally stiff to very stiff, lean and fat clays containing some sand. Scattered lenses of compacted clayey and silty sands were also encountered within the levees (e.g. Sta. 30+10 and Sta. 26+55).

Below the fills, the borings generally encountered low to highly plastic clay layers interbedded with sand lenses/layers. The interbedded sand layers generally diminish downstream from approximate Sta. 25+00. Organic clays, locally known as bay mud were encountered under the levee fill in borings drilled downstream of approximate Sta. 24+50.

The clay layers underlying the site predominantly consist of lean clays (CL) containing varying amounts of fine sands. The Plasticity Indices (PI) and Liquid Limits (LL) of these clays usually vary between 9 to 31 percent and 29 to 49 percent, respectively. These clays are medium to very stiff and have natural water content and total unit weights in the range of 10 to 25 percent and 18 kN/m^3 to 19.7 kN/m^3 (115 pcf to 125 pcf), respectively. Most of the lean clay layers encountered in our borings appear to be slightly to moderately overconsolidated. The overconsolidation appears to be due to drying and desiccation of the clays just after they were deposited.

Discontinuous, fat clay (CH) layers were encountered at some locations, between the levee fill and the underlying lean clay layers. These fat clay layers are usually about 1.5 m to 3 m (5 feet to 10 feet) thick. They usually contain some sand, and are generally stiff to very stiff in consistency. Based on the Atterberg limits test data, these fat clays are characterized as having medium to high potential for expansion.. Fat clays are very fine grained and are deposited in calm environments such as basins. The fat clays at the site appear to be moderately overconsolidated.

An about 1.5 m to 3 m (5 feet to 10 feet) thick layer of organic clays (locally known as "Bay Mud") was encountered in the borings drilled downstream of approximate Sta. 24+50. This layer was encountered between the levee fill and the underlying lean clay layers. The bay mud encountered in our borings is medium stiff and usually has a natural moisture content range of 50 to 70 percent. Total unit weights of these organic clays generally range from 14 to 15 kN/m^3 (89 to 95 pcf). These organic clays were deposited in a marine environment and may contain shells and scattered peat. Based on the laboratory test results, the bay mud at the site appears to be slightly overconsolidated.

Sand layers/lenses were mostly encountered upstream of approximate Sta. 25+00. The sand layers underlying the site are mostly discontinuous, randomly scattered and are usually about 1.5 to 3 m (5 feet to 10 feet) thick. The sands encountered in our borings are generally fine grained and contain substantial non-plastic fines (silts). They are generally medium dense.

Groundwater was encountered in our borings at depths ranging from 3.5 m to 6 m (11.5 feet to 21 feet). We expect the groundwater at the site to be at or near the creek bottom. It should be noted that the groundwater level at the site may change with passage of time due to groundwater fluctuations from season to season, weather conditions, and other factors which may not have been present at the time of the investigation.

Detailed descriptions of the materials encountered in the exploratory borings are presented on boring logs attached in Appendix A. The descriptions and related information presented on these logs of test borings depict subsurface conditions only at the locations indicated on the plan and on the particular date noted on the logs. Subsurface conditions at other locations may differ from conditions occurring at the locations explored. Also, the passage of time may result in a change in the soil conditions at these locations due to environmental changes.

EARTHQUAKE CONSIDERATIONS

The project site is located in a seismically active part of northern California. Many faults exist in the San Francisco Bay Area which are capable of producing earthquakes which may cause strong ground shaking at the site. Attached Plate 4, Fault Map presents the locations of the fault systems relative to the project site.

Maximum credible earthquake is defined as the maximum earthquake that appears capable of occurring under the known tectonic frame. Maximum credible earthquake magnitudes for some of the major faults in the area determined by Mualchin (1996) are summarized in Table 1. These maximum credible earthquake magnitudes represent the largest earthquakes that could occur on the given fault based on the current understanding of the regional tectonic structure.

TABLE 1

Fault	Distance from Site (km)	Maximum Credible Earthquake Magnitude
San Andreas	14.5	8
Hayward	15.0	7½
Calaveras	22.0	7½
Monte Vista West	10.5	6½
Monte Vista East	4.5	6½

Potential seismic hazards at a site may arise from these sources: surface fault rupture, strong ground shaking and liquefaction. No known active or potentially active faults cross the project site. Therefore, in our opinion, the potential for ground surface rupture due to faulting at the site is considered low.

As shown on Plate 4, Fault Map, active faults including San Andreas Fault, Hayward Fault, Monte Vista East, Monte Vista West and Calaveras Fault are located in the vicinity of the site.

A major earthquake on these faults is expected to produce very strong ground shaking at the site. Based on the map prepared by Mualchin (1996) a peak bedrock acceleration of about 0.4g is anticipated at the site. The corresponding peak ground acceleration may be on the order of 0.3g.

Soil liquefaction is a phenomenon in which saturated cohesionless soils are subject to a temporary but essentially total loss of shear strength under the reversing, cyclic shear stresses associated with earthquake shaking. Submerged cohesionless silts and sands of low relative density are the type of soils which usually are susceptible to liquefaction. Clays are generally not susceptible to liquefaction.

Analyses of the liquefaction potential of isolated sand deposits underlying the site were performed using the procedure developed by Seed and Idriss (1982) for a magnitude 7½ earthquake on the nearby Hayward Fault resulting in a peak ground acceleration of about 0.3g. This method compares estimates of the earthquake-induced shear stress to the susceptibility of soil liquefaction. Cohesionless soils below a depth of 15 m (50 feet) and cohesionless soils above the groundwater level were considered to have low liquefaction potential. Based on our analyses, many of the shallower, discontinuous medium dense sand and silty sand deposits underlying the site may liquefy during a strong earthquake. The extent and consequences of this liquefaction was further studied from historical data compiled by Youd and Hoose (1978). Youd and Hoose have documented evidence of liquefaction related phenomenon in the site vicinity during the California Earthquake of April 18, 1906 on the nearby San Andreas Fault. No liquefaction site has been identified by them in the project vicinity. No evidence of liquefaction are documented in the immediate site vicinity during the 1906 earthquake or the recent Loma Prieta Earthquake (1989).

Based on historical evidence, the present topography at the site and considering that the soils which overlie the potentially liquefiable soils are predominantly cohesive in nature, in our opinion, the consequences of liquefaction in the area could be limited to some post-liquefaction settlements of the ground surface. It is estimated that the post-liquefaction settlements may be on the order of 10 mm to 35 mm (0.375 inches to 1.375 inches), and probably would be random and localized.

FINDINGS AND DISCUSSIONS

Evaluation of Existing Levees

The existing levee sections were analyzed for seepage and slope stability as per guidelines outlined in US Army Corps of Engineer's Levee design and construction manual EM 1110-2-1913. The results of these analyses are discussed in the following subsections.

Seepage Analysis

Analyses for seepage through- and under- the levee were conducted. The existing levee sections used in the analysis are shown on plates attached in Appendix C.

The existing levee fills and the underlying native soils are predominantly lean and sandy lean clays. Therefore, the levee materials and the underlying soils were modeled as clays for seepage analysis. Laboratory permeability tests were not performed on these fine grained soils and their permeabilities were estimated from other laboratory test results and readily available empirical relationships.

Seepage analyses were performed using a finite element computer program, SEEP2D which was developed at Brigham Young University. The design maximum probable flood level for seepage analysis was taken to be about 1.5 m (5 feet) below the top of the existing and modified levees. Since the landside slopes of the levees have been backfilled, seepage at the site is mainly in the form of percolation towards the groundwater table located just below or at the bottom of the creek. Based on these results and based on the duration of the probable maximum flood event (3 to 4 days), it is anticipated that the seepage across the levees will be negligible and the levee materials are not expected to get saturated during these probable maximum flood events. The studies indicate that seepage control measures may not be required. The phreatic surfaces estimated during seepage analysis are as shown on plates attached in Appendix C. These phreatic surfaces were further used for slope stability analyses.

Slope Stability Analysis

Slope stability analyses were performed on the existing levee sections using Bishop's method and the computer program UTEXAS3 developed by Stephen Wright of the University of Texas at Austin. Computer program XSTABL, was also used for some slope stability conditions and to verify results obtained from UTEXAS3.

Critical sections used for the slope stability analyses were developed based on the existing and proposed slope geometries, geology, field observations, boring logs and laboratory test results.

In general, these sections are to be analyzed for Cases I to V outlined in the US Army Corps of Engineer's Manual EM 1110-2-1913. These critical conditions and the corresponding minimum strength and factors of safety requirements are presented on Table 2.

TABLE 2

CASE NO.	DESIGN CONDITION	SLOPE ANALYZED	SHEAR STRENGTH	MINIMUM FACTOR OF SAFETY
I	End of Construction	Creekside & Landside	Q or S	1.3
II	Sudden Drawdown	Creekside	S where < R R where < S	1.0
III	Intermediate River stage	Creekside	S where < R (R+S)/2 where R < S	1.4
IV	Steady seepage from full flood stage	Landside	S where < R (R+S)/2 where R < S	1.4
V	Earthquake: Case I, or III with seismic loading	Creekside and Landside	Seismic Coefficient 0.2g	1.0

In our opinion. the excess pore water pressures under the existing levees have dissipated after its modifications and therefore the End of Construction case (Case I) was not analyzed for the existing levee sections. However, we have analyzed the levees for existing conditions using total stress analysis. The landside of the levee slopes have been backfilled along most of the alignment. Therefore, stability for Case IV is not applicable. Only creekside slope stability was evaluated for this study i.e. Cases II, III and V.

The strength parameters used in the analysis are presented on Plates C-1 to C-12. These strength parameters were estimated from field Standard Penetration Test results, pocket penetrometer test results, unconfined compression test results, and triaxial consolidated undrained tests with pore water measurements (Appendix B). Where the triaxial test results showed some scatter, the effective and total strength envelopes used in the analysis were conservatively estimated based on the test results, engineering judgement and published empirical relations.

Tension cracks were assumed in the upper 1.5 m (5 feet) of the levee top and side slopes. The tension cracks were assumed to be filled with 0.9 m (3 feet) of water. The maintenance road on top of the levee is presently being used. The load of the levee due to the traffic on the top was modeled as an uniform surcharge of 12 kPa (250 psf).

Earthquake loading conditions were modeled by using a seismic loading coefficient of 0.2g for pseudo-static analysis. The shear strengths, unit weights, geometry, phreatic surfaces used in the analyses and the factors of safety and possible critical sliding surfaces obtained from slope stability analyses are presented on Plates C-1 to C-12. The factor of safety for Case III i.e. Intermediate River Stage is the minimum obtained by varying the water within the creek level from creek bottom to the maximum design flood level. Due to relatively long duration of creek levels expected for this case, the groundwater was assumed to rise to the creek water level for this analysis.

The factors of safety obtained from the analyses are summarized on Table 3. Based on these results, it is concluded that the existing and modified levees proposed for the project have adequate stability under static and seismic loading conditions.

The stability analyses evaluates the global slope stability. Minor sloughing, cracking, etc. should be anticipated due to clayey nature of the levee fill. Rodent burrows, etc. were also observed during our site visits. Existing and future sloughing, cracking, gullying, erosion, etc. should be addressed as a part of regular maintenance.

TABLE 3

Location (Riverside slopes)	**Factors of Safety for Existing Levee Sections**							
	Static Cases				**Seismic Cases (0.2g)**			
	Existing	**II**	**III**	**IV**	**Existing**	**II**	**III**	**IV**
Sta. 32+00 to Sta. 38+70	5.5	1.6	1.9	NA	3.7	1.13	1.3	NA
Sta. 26+50 to Sta. 32+00	4.4	1.8	2.4	NA	2.8	1.2	1.5	NA
Sta. 23+00 to Sta. 26+50	4.4	2.1	2.0	NA	2.8	1.5	1.4	NA
Sta. 19+50 to Sta. 23+00	2.9	1.6	1.5	NA	1.9	1.04	1.0	NA

We understand that the creek capacities may be increased in the future by raising the levees, constructing floodwalls, etc. We believe that this could adversely impact the levee stability, especially downstream of Sta. 24+50, where the soils are weaker than the remaining alignment. Levee stability should be re-evaluated if the levees are planned to be modified in the future.

INVESTIGATION LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices and are based on our field exploration and the assumption that the soil conditions do not deviate from observed conditions. No warranty, expressed or implied, of merchantability or fitness, is made or intended in connection with our work or by the furnishing of oral or written reports or findings. The scope of our services did not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in structures, soil, surface water, groundwater or air, below or around this site. Unanticipated soil conditions are commonly encountered and cannot be fully determined by taking soil samples and excavating test borings; different soil conditions may require that additional expenditures be made during construction to attain a properly constructed project. Some contingency fund is thus recommended to accommodate these possible extra costs.

The findings in this report are valid as of the present date. However, changes in the soil conditions can occur with the passage of time , whether they be due to natural processes or to the works of man, on this or adjacent properties. In addition, changes in applicable or appropriate standards occur, whether they result from legislation or from the broadening of knowledge. Accordingly, the findings in this report might be invalidated, wholly or partially, by changes outside of our control.

Very truly yours,
PARIKH CONSULTANTS, INC.

Hemang Desai, P.E., C57931
Project Engineer

Gary Parikh, P.E., G.E. 666
Project Manager

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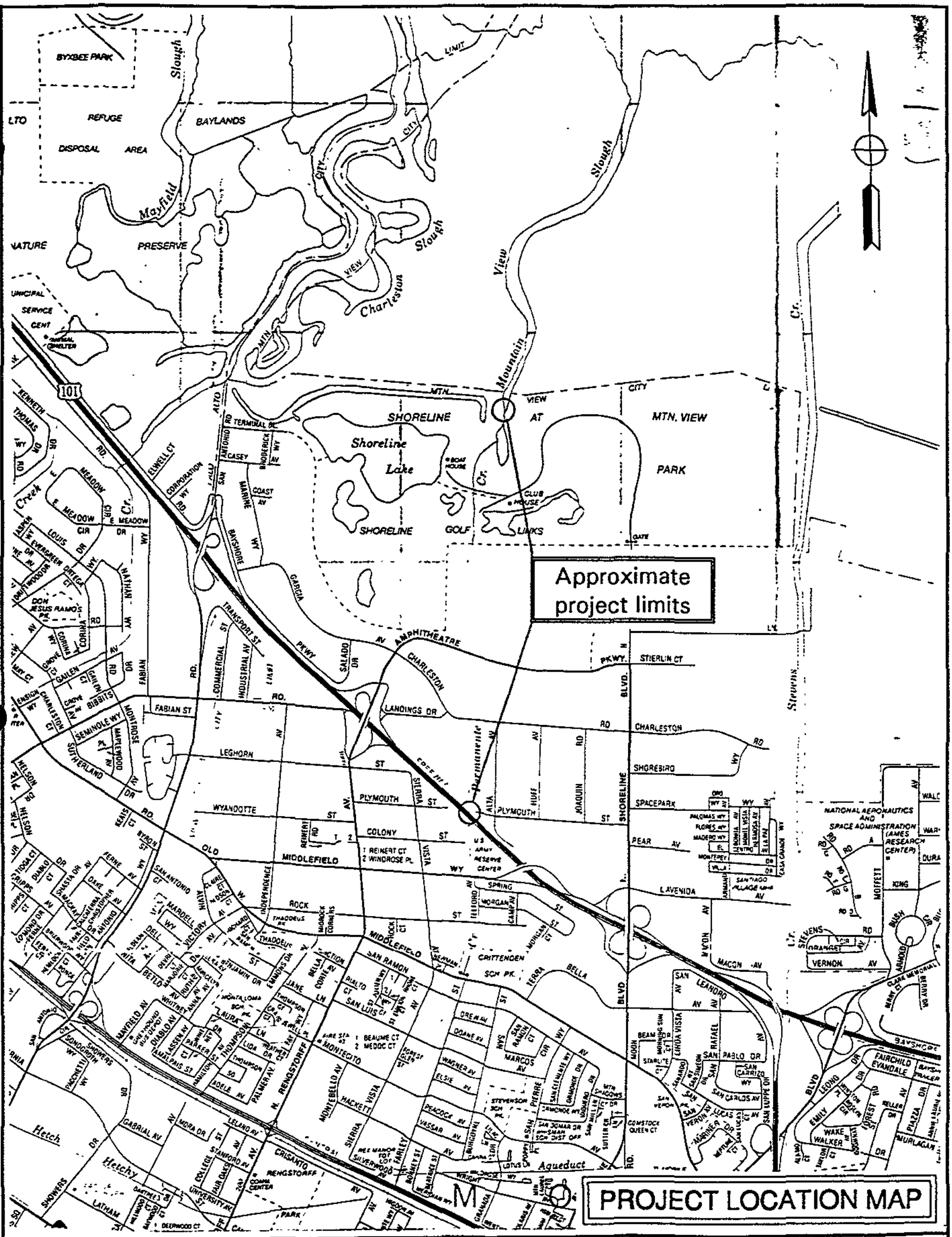

Approximate project limits

PROJECT LOCATION MAP

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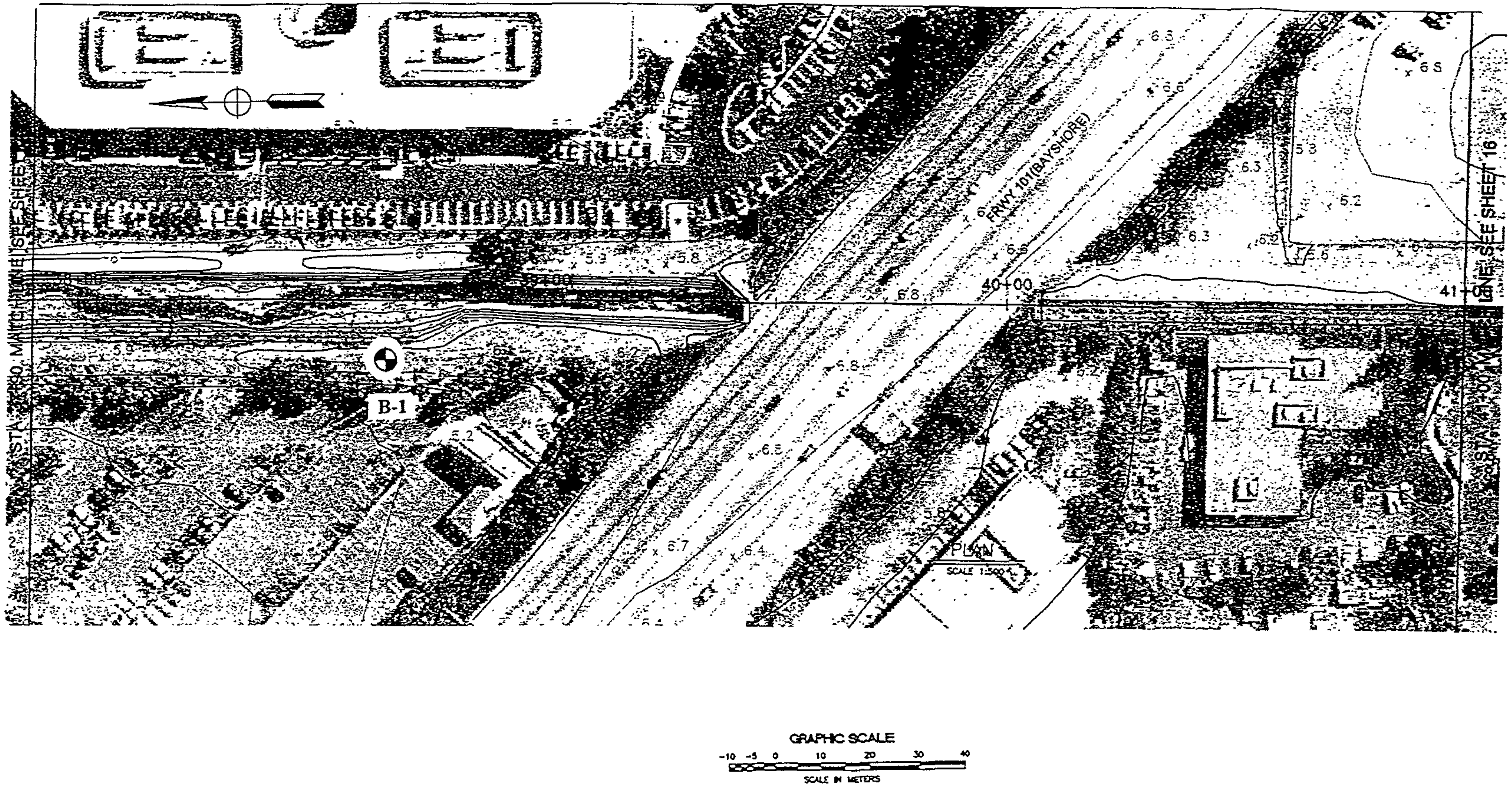
MATERIALS ENGINEERING

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10	PLATE NO: 1



SCALE: 1:1,000

SITE PLAN

SOURCE: Santa Clara Valley Water District, Map and General Plan for Permanente Creek and Hale Creek, San Francisco Bay to Foothill Expressway, Dated 3/12/99

LEGEND:

⊕ Approx. Boring Location

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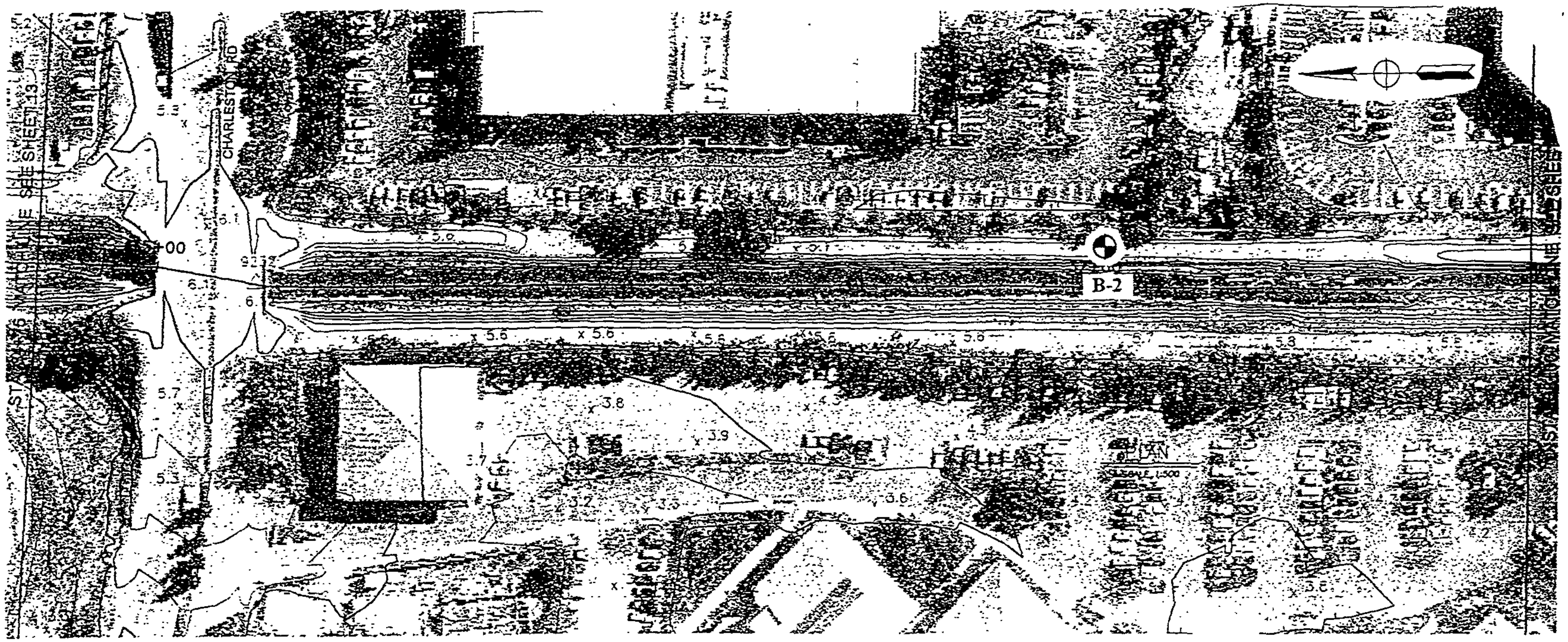
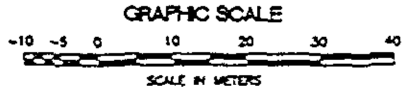
PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10

PLATE NO.: 2A





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SITE PLAN

SOURCE: Santa Clara Valley Water District, Map and General Plan for Permanente Creek and Hale Creek, San Francisco Bay to Foothill Expressway, Dated 3/12/99

LEGEND:

⊕ Approx. Boring Location

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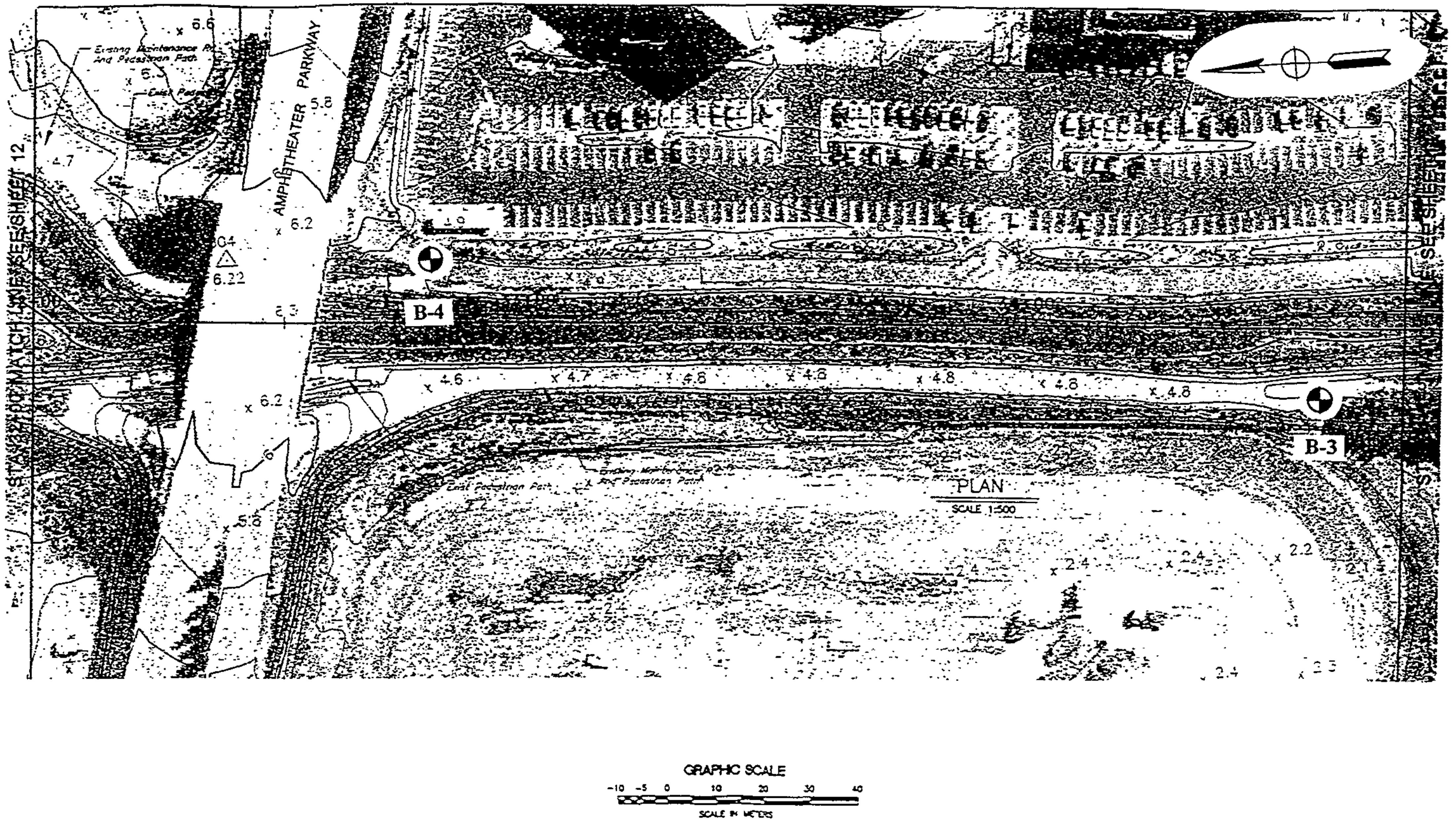
PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10

PLATE NO.: 2B



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SITE PLAN

SOURCE: Santa Clara Valley Water District, Map and General Plan for Permanente Creek and Hale Creek, San Francisco Bay to Foothill Expressway, Dated 3/12/99

LEGEND:

⊕ Approx. Boring Location

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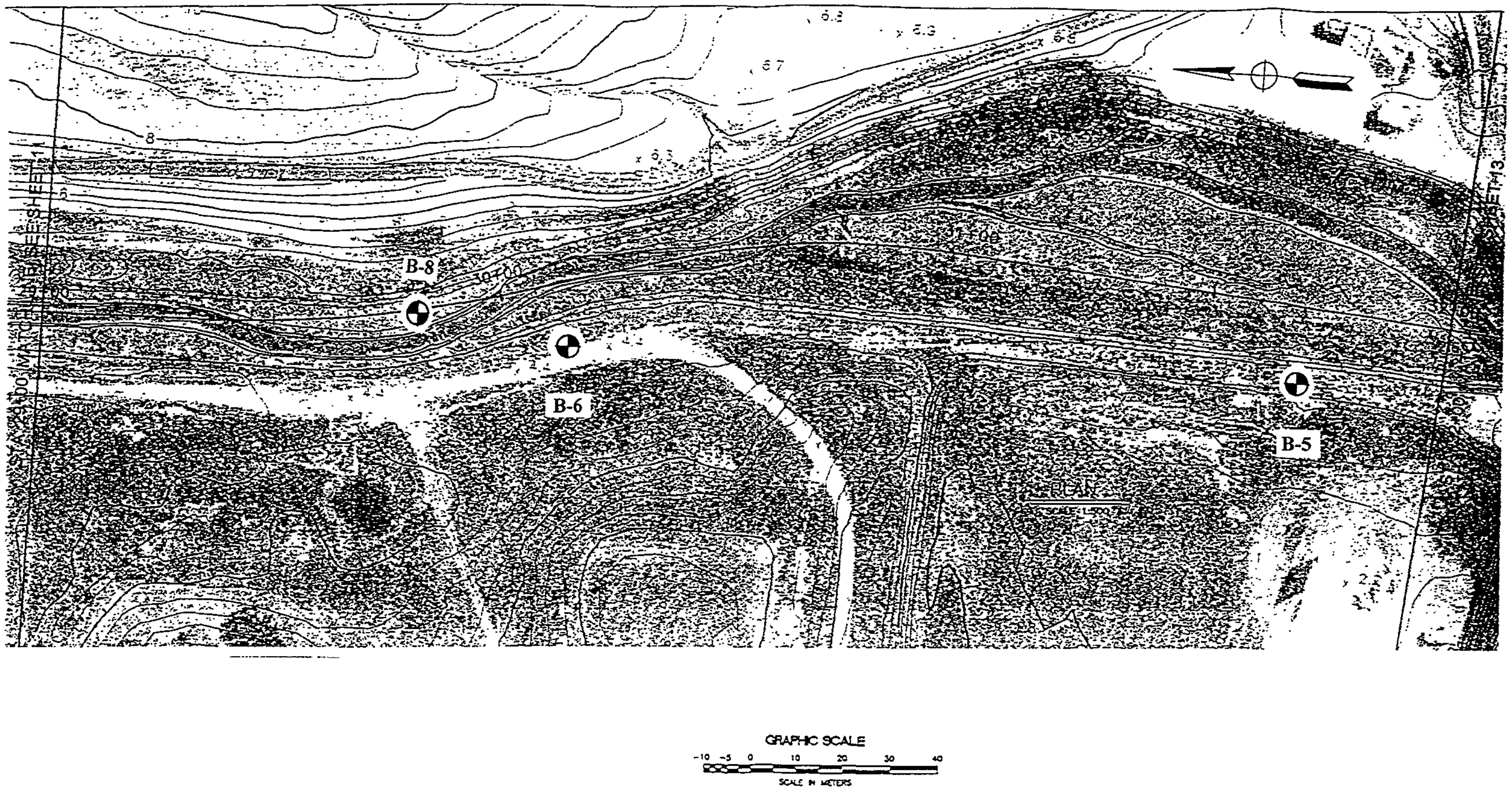
PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10

PLATE NO.: 2C



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SITE PLAN

SOURCE: Santa Clara Valley Water District, Map and General Plan for Permanente Creek and Hale Creek, San Francisco Bay to Foothill Expressway, Dated 3/12/99

LEGEND:

⊕ Approx. Boring Location

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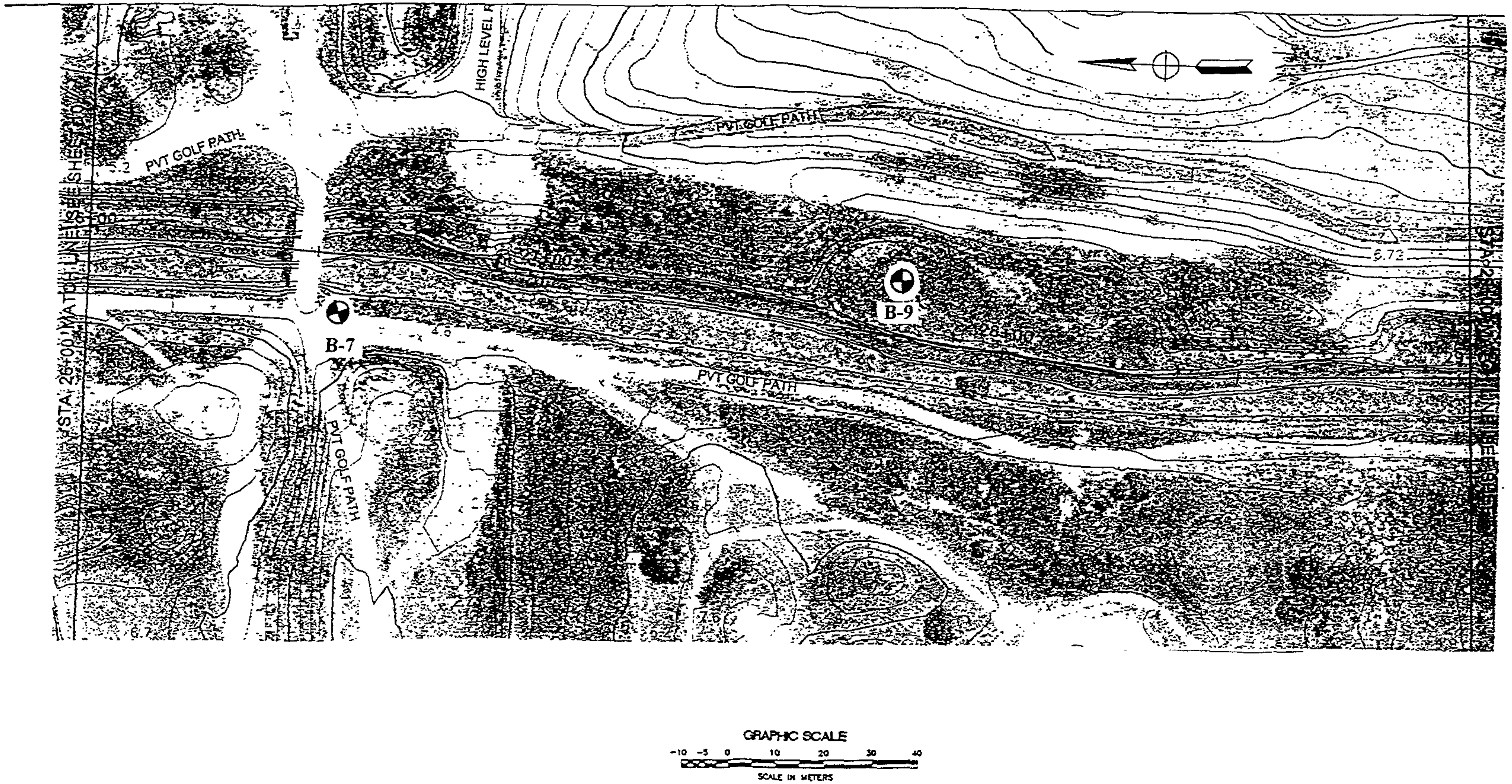
PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10

PLATE NO.: 2D



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SITE PLAN

SOURCE: Santa Clara Valley Water District, Map and General Plan for Permanente Creek and Hale Creek, San Francisco Bay to Foothill Expressway, Dated 3/12/99

LEGEND:

⊕ Approx. Boring Location

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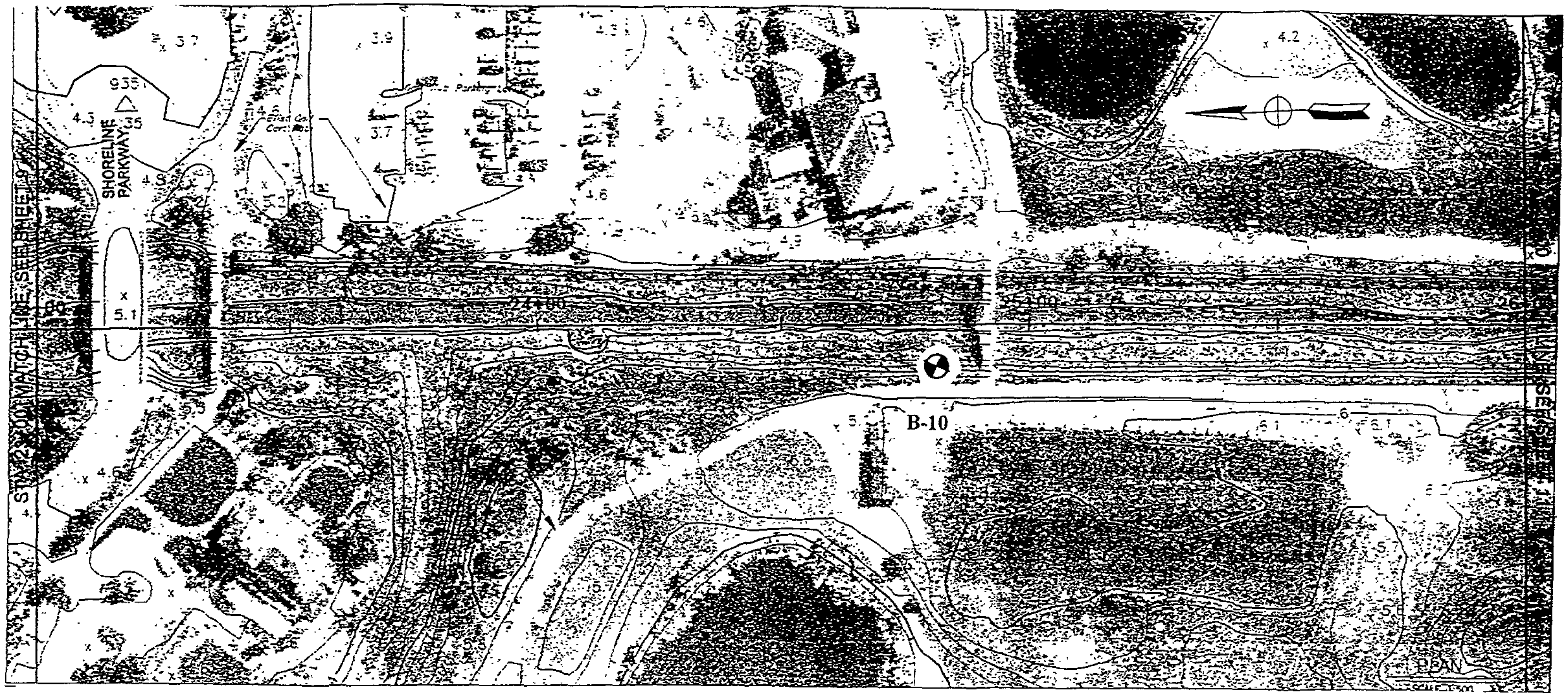
JOB NO.: 99106.10

PLATE NO.: 2E



GRAPHIC SCALE
-10 -5 0 10 20 30 40
SCALE IN METERS

SCALE: 1:1,000

SITE PLAN

SOURCE: Santa Clara Valley Water District, Map and General Plan for Permanente Creek and Hale Creek, San Francisco Bay to Foothill Expressway, Dated 3/12/99

LEGEND:

⊕ Approx. Boring Location

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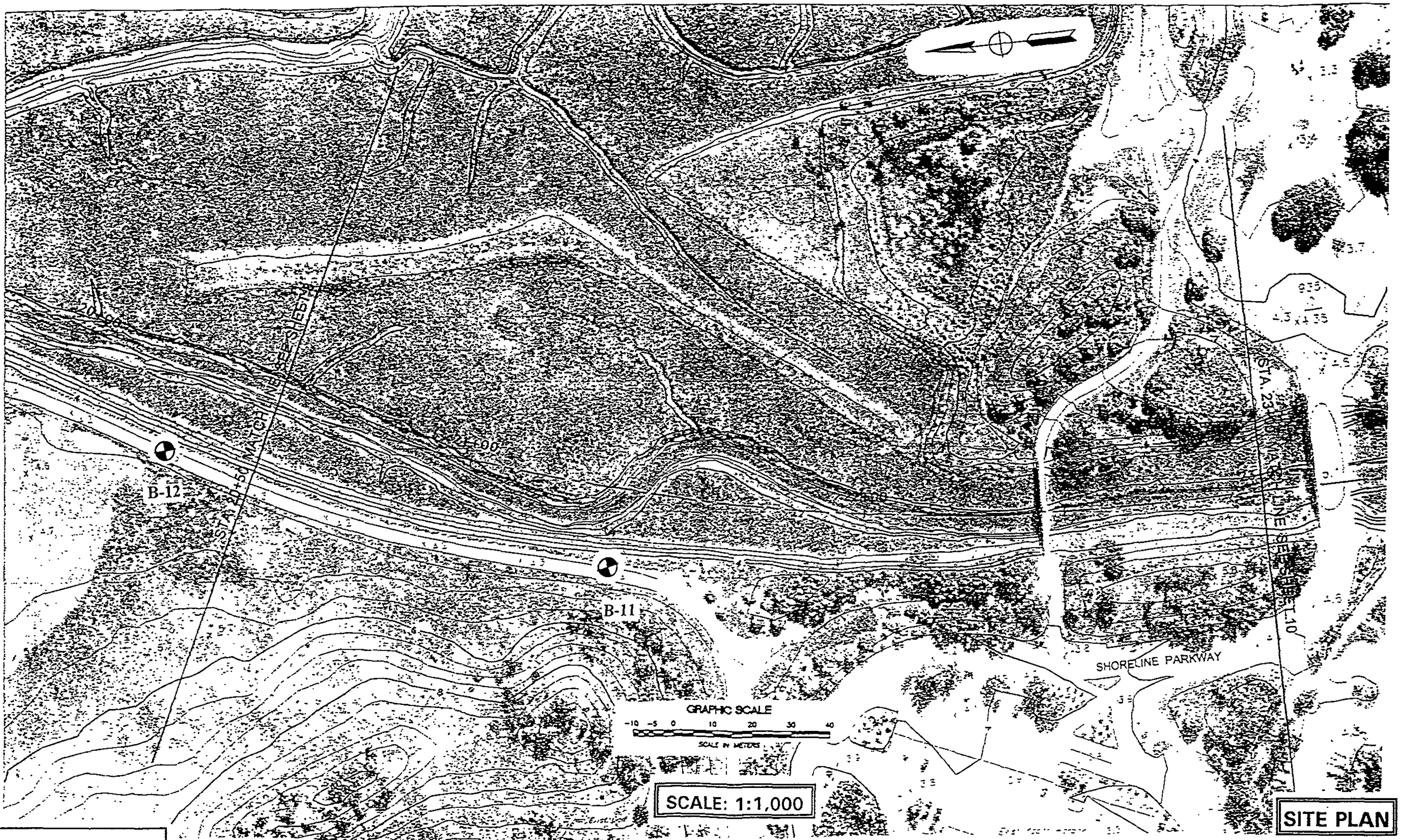
JOB NO.: 99106.10

PLATE NO.: 2F



SCALE: 1:1,000

SITE PLAN

SOURCE: Santa Clara Valley Water District, Map and General Plan for Permanente Creek and Hale Creek, San Francisco Bay to Foothill Expressway, Dated 3/12/99

LEGEND:

● Approx. Boring Location

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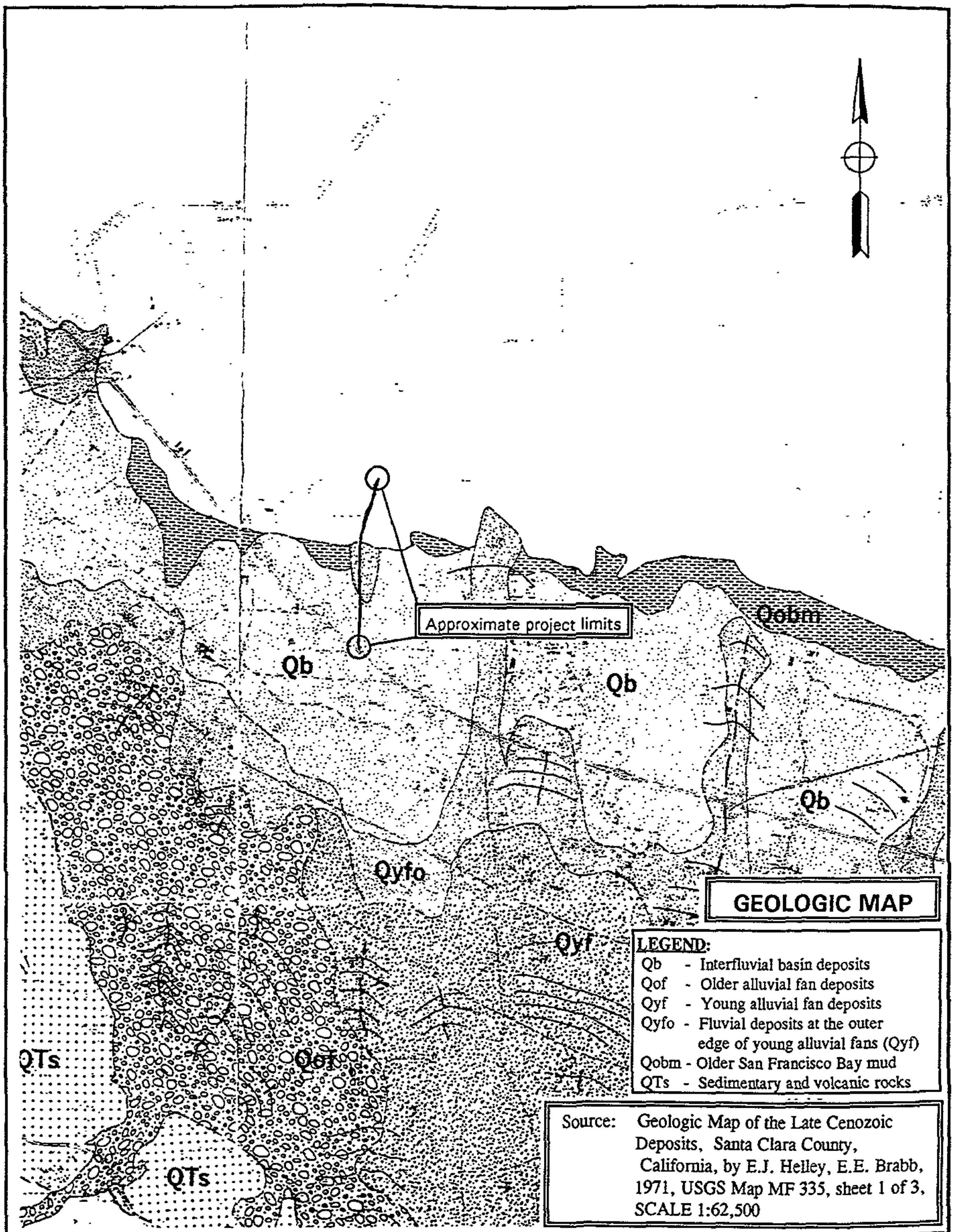
JOB NO.: 99106.10	PLATE NO.: 2G



GEOLOGIC MAP

LEGEND:

Qb	- Interfluvial basin deposits
Qof	- Older alluvial fan deposits
Qyf	- Young alluvial fan deposits
Qyfo	- Fluvial deposits at the outer edge of young alluvial fans (Qyf)
Qobm	- Older San Francisco Bay mud
QTs	- Sedimentary and volcanic rocks

Source: Geologic Map of the Late Cenozoic Deposits, Santa Clara County, California, by E.J. Helley, E.E. Brabb, 1971, USGS Map MF 335, sheet 1 of 3, SCALE 1:62,500

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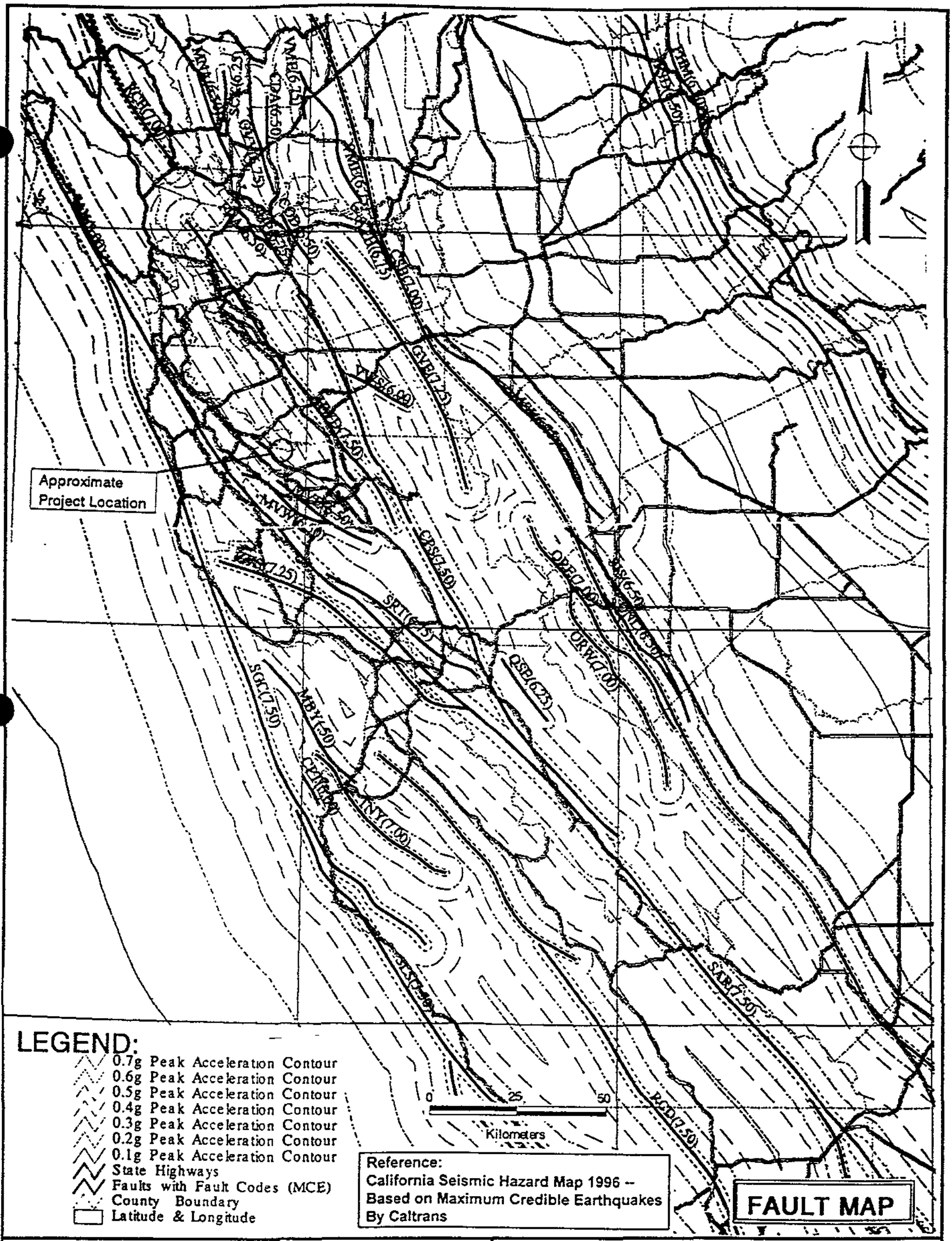
JOB NO.: 99106.10

PLATE NO: 3



LEGEND:

- 0.7g Peak Acceleration Contour
- 0.6g Peak Acceleration Contour
- 0.5g Peak Acceleration Contour
- 0.4g Peak Acceleration Contour
- 0.3g Peak Acceleration Contour
- 0.2g Peak Acceleration Contour
- 0.1g Peak Acceleration Contour
- State Highways
- Faults with Fault Codes (MCE)
- County Boundary
- Latitude & Longitude

Reference:
California Seismic Hazard Map 1996 --
Based on Maximum Credible Earthquakes
By Caltrans

FAULT MAP

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CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10	PLATE NO: 4

APPENDIX A

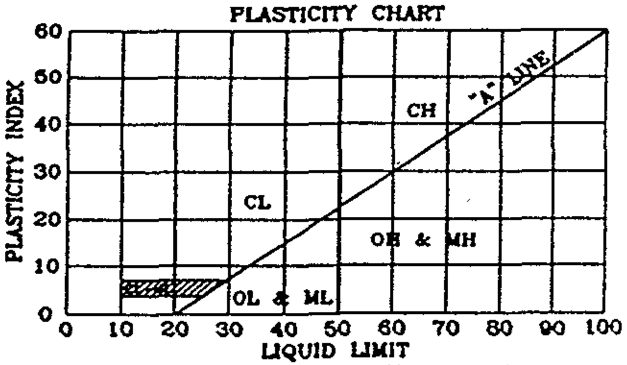
UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	ILLUSTRATIVE GROUP NAMES
COARSE-GRAINED SOILS More than 50% retained on No. 200 sieve	GRAVELS More than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS Less than 5% fines	GW	Well graded gravel, Well graded gravel with sand
			GP	Poorly graded gravel, Poorly graded gravel with sand
		GRAVELS WITH FINES More than 12% fines	GM	Silty gravel, Silty gravel with sand
			GC	Clayey gravel, Clayey gravel with sand
	SANDS 50% or more of coarse fraction passing No. 4 sieve	CLEAN SANDS Less than 5% fines	SW	Well graded sand, Well graded sand with gravel
			SP	Poorly graded sand, Poorly graded sand with gravel
		SANDS WITH FINES More than 12% fines	SM	Silty sand, Silty sand with gravel
			SC	Clayey sand, Clayey sand with gravel
FINE-GRAINED SOILS 50% or more passing No. 200 sieve	SILTS AND CLAYS Liquid Limit less than 50%		ML	Silt, Sandy silt with gravel
			CL	Lean clay, Sandy lean clay with gravel
			OL	Organic clay, Sandy organic clay with gravel
	SILTS AND CLAYS Liquid Limit more than 50%		MH	Elastic silt, Sandy elastic silt with gravel
			CH	Fat clay, Sandy fat clay with gravel
			OH	Organic clay, Sandy organic clay with gravel
HIGHLY ORGANIC			PT	Peat, Highly organic silts

NOTE: 1. Coarse-grained soils receive dual symbols if: (a) their fines are CL-ML (e.g. SC-SM or GC-GM) or (b) they contain 5-12% fines (e.g. SW-SM, GP-GC, etc.). Fine-grained soils receive dual symbols if their limits plot in the hatched zone of the Plasticity Chart (CL-ML).

2. The table lists 30 out of a possible 110 Group Names, all of which are assigned to unique proportions of the constituent soils. Flow charts in ASTM D 2487-93 aid assignment of the Group Names.

PLASTICITY CHART



GRAIN SIZE CLASSIFICATION

CLASSIFICATION	US STANDARD SIEVE SIZE
BOULDERS	Above 12"
COBBLES	12" to 3"
GRAVEL	
Coarse	3" to 3/4"
Fine	3/4" to No. 4
SAND	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No.200
SILT & CLAY	Below No. 200

COHESIVE SOIL CONSISTENCY

CLASSIFICATION	UNCONFINED COMP. STRENGTH (psf)
Very Soft	< 500
Soft	500 - 1000
Medium(Firm)	1000 - 2000
Stiff	2000 - 4000
Very Stiff	4000 - 8000
Hard	> 8000

COHESIONLESS SOIL RELATIVE DENSITY

CLASSIFICATION	SPT BLOW COUNTS (Blows/ft)
Very Loose	< 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	> 50

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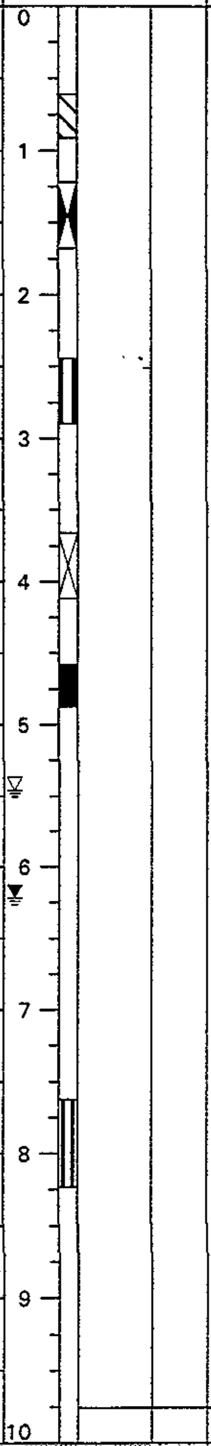
JOB NO.: 99170.10

PLATE NO: A-1A

Boring Location, Elevation & Date Drilled: ; Elev. approx. m.; drilled on	Drilling Method: -cm dia.	BORING NUMBER **LEGEND**
	Sampling Method:	Sheet 1 of 1

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)
1			22	
2	110	12	23	1.2
3	98	28	100 psi	0.8
4	-	10	35	-
5	95	20		0.7
6	-	-		12.0



Compressive strength as measured by Pocket Penetrometer, in tsf.	pp=1.0tsf
2 inch I.D. California Sampler (C).	
2-1/2 inch I.D. Modified California Sampler (MC).	
3.5-inch I.D. Pitcher Tube Sampler (Cored).	
1-3/8 inch I.D. Standard Splitspoon Sampler (SPT).	
1.9 inch I.D. Hand Sampler driven with a slide hammer.	
Groundwater level first encountered during drilling	
Groundwater level at completion of boring	
Liquid Limit (LL), in percent Plasticity Index (PI), in percent	LL=30 PI=10
NX Core.	
Percent gravel and coarser in sample,(+#4) Percent fines (silt/clay) in sample, (-#200)	+#4=20% -#200=50%
Direct Shear Test	DS

LEGEND FOR LOG OF BORING

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PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000
Job No.: 99106.10

LEGEN 1-4-00

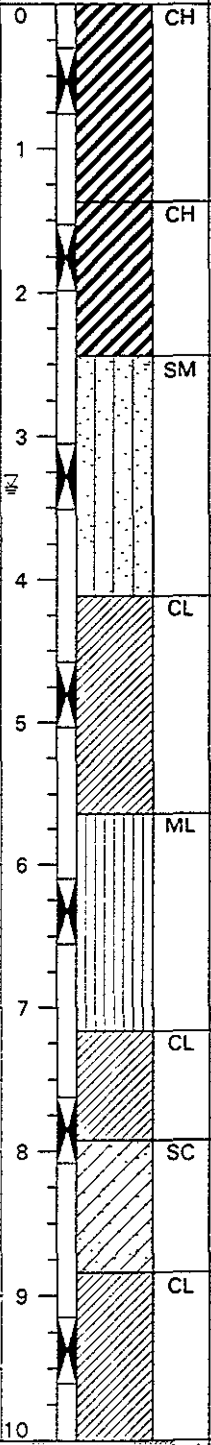
This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-1B

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 6.1 m.; drilled on 7-28-99	Drilling Method: 20-cm dia. Hollow stem auger Mobil B-56 rig	BORING NUMBER **B-1**
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 1 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)
MC-1	15.40	22	27	
MC-2	14.93	24	47	
MC-3	19.17	15	54	
MC-4	15.56	26	20	
MC-5	16.66	21	28	
MC-6	20.11	15	27	
MC-7	15.71	25	26	115

Depth (m) Soil Graph & U.S.C.S.



U.S.C.S.	Description	
CH	Dark brown/gray with white pockets SANDY FAT CLAY, trace gravel, sand and gravel are angular to subangular, gravel up to 19 mm, pieces of glass, very stiff, moist (Fill)	
CH	Dark gray to black with white pockets FAT CLAY, trace sand and gravel, rootlets, hard	pp=350 kPa LL=64 PI=42
SM	Brown to dark brown SILTY SAND, pockets of clay and fine rounded gravel, hard, moist to wet	
CL	Light brown/gray, mottled LEAN CLAY, trace fine sand, stiff, wet	LL=29 PI=9
ML	Gray/green SANDY SILT,very fine grained sand, very stiff, wet	+#4=0% -#200=63% pp=75 kPa
CL	Gray/green LEAN CLAY WITH SAND, trace rounded gravel up to 25 mm, very stiff, wet	pp=50 kPa
SC	Light gray CLAYEY SAND, trace gravel, sand is coarse and angular, medium dense, wet	
CL	Light grayish brown with white pockets LEAN CLAY, trace sand, very stiff, wet	pp=150 kPa

LOG OF BORING

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PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000
Job No.: 99106.10

106 1-3-00

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Plate:
A-2A

Boring Location, Elevation & Date Drilled:
SEE ATTACHED SITE PLAN; Elev. approx. 6.1 m.; drilled on 7-28-99

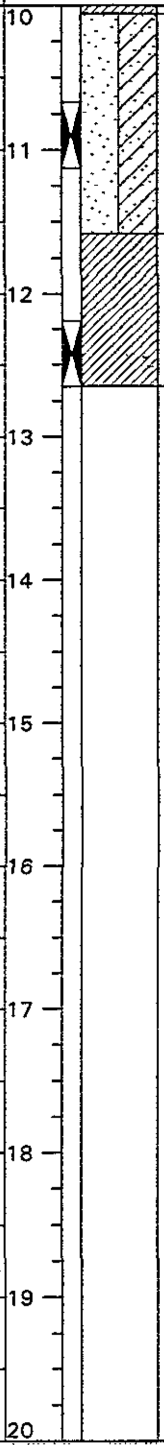
Drilling Method:
20-cm dia. Hollow stem auger
Mobil B-56 rig

Sampling Method:
64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.

BORING NUMBER
B-1

Sheet 2 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)
MC-8	18.54	16	35	
MC-9	15.87	24	26	96



U.S.C.S.	Description	
SP SC	Brown POORLY GRADED SAND WITH CLAY, trace gravel, pockets of clay, medium dense, wet	+#4 = 9% -#200 = 9%
CL	Light grayish brown with white pockets LEAN CLAY, very stiff, wet	pp = 150 kPa
	Bottom of drillhole at 12.7 m Groundwater encountered at 3.4 m during drilling	

LOG OF BORING

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PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000

Job No.: 99106.10

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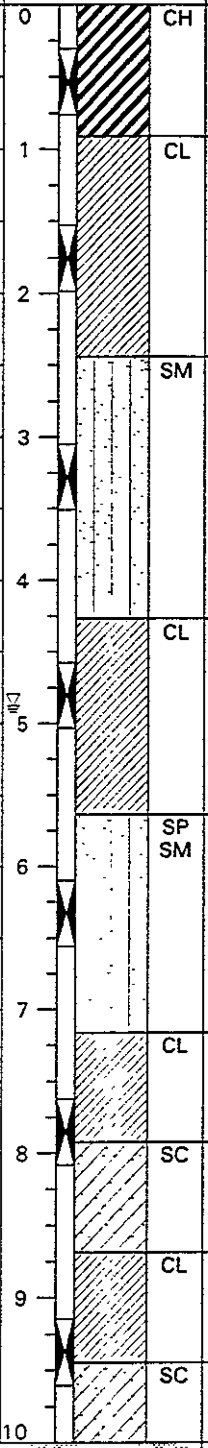
Plate:
A-2B

106 1-3-00

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 5.0 m.; drilled on 7-28-99	Drilling Method: 20-cm dia. Hollow stem auger Mobil B-56 rig	**BORING NUMBER** **B-2**
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 1 of 2



Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	U.S.C.S.	Description	
MC-1	18.39	11	50/10 cm	512	CH	Dark gray/brown with white coloration SANDY FAT CLAY, trace gravel, hard, damp (Fill)	
MC-2	16.19	20	42	335	CL	Dark gray/black LEAN CLAY, trace sand and fine gravel, very stiff, damp to moist	LL=49 PI=31
MC-3	16.03	23	24		SM	Light gray/brown mottled with orange SILTY SAND, pockets of clay, medium dense, moist	
MC-4	16.19	25	21	57	CL	Light brown/gray mottled, LEAN CLAY, pockets of sand, stiff, wet	pp=50 kPa
MC-5	17.91	19	31		SP SM	Brown POORLY GRADED SAND WITH SILT, trace gravel, pockets of clay, medium dense, wet	+#4=0% -#200=8%
MC-6	20.90	12	63		CL	Brown/gray LEAN CLAY WITH SAND, sand is coarse and angular, very stiff, wet	
					SC	Brown CLAYEY SAND, trace gravel, dense, wet	
MC-7	20.43	14	35		CL	Brown SANDY LEAN CLAY, sand is coarse and angular, very stiff, wet	LL=35 PI=20
					SC	Brown/gray CLAYEY SAND, trace gravel, sand is	

LOG OF BORING

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

Date: 1/2000

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Plate:

A-3A

106 1-3-00

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 5.0 m.; drilled on 7-28-99	**Drilling Method:** 20-cm dia. Hollow stem auger Mobil B-56 rig	**BORING NUMBER** **B-2**
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 2 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Depth (m) Soil Graph & U.S.C.S.		
					10	coarse and angular, medium dense, wet	
MC-8	15.87	25	35		CL	Light brown/gray, mottled orange LEAN CLAY, very stiff, wet	pp = 50 kPa
					11 SP	Brown POORLY GRADED SAND, trace gravel, sand is coarse and subrounded to subangular, medium dense, wet	
MC-9	19.49	15	41		12		
						Bottom of drillhole at 12.7 m Groundwater encountered at 4.9 m during drilling	
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

LOG OF BORING

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PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000

Job No.: 99106.10

Plate: A-3B

106 1-3-00

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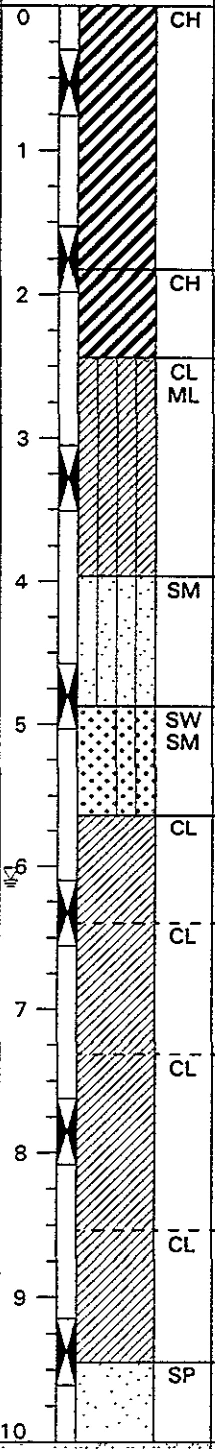
Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 5.0 m.; drilled on 7-28-99	Drilling Method: 20-cm dia. Hollow stem auger Mobil B-56 rig	BORING NUMBER **B-3**
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 1 of 2



Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Depth (m) Soil Graph & U.S.C.S.	Description	
					CH	Dark brown to dark gray, white coloration, SANDY FAT CLAY, trace gravel, firm, dry to damp (Fill)	
MC-1	17.29	16	11				
MC-2	18.54	12	25	129			
					CH	Dark brown to dark gray FAT CLAY WITH SAND, occasional gravel, very stiff, moist	
					CL ML	Gray/light brown SILTY CLAY, stiff, moist	pp = 150 kPa LL = 23 PI = 7
MC-3	19.33	14	15				
					SM	Grayish brown SILTY SAND, pockets of clay	
MC-4	20.11	11	50/15 cm				
					SW SM	Brown WELL GRADED SAND WITH SILT AND GRAVEL, gravel up to 19 mm, very dense, wet	+#4 = 33% -#200 = 5%
					CL	Brown/gray, mottled orange SANDY LEAN CLAY, very fine sand, very stiff, wet	
MC-5	15.56	24	42	48			
					CL	Brown/gray LEAN CLAY WITH SAND, very fine sand, very stiff, wet	pp = 125 kPa
					CL	Grayish green LEAN CLAY, trace fine sand, occasional gravel, stiff, wet	
MC-6	15.24	28	22				pp = 300 kPa
					CL	Grayish brown LEAN CLAY WITH SAND, sand is coarse and angular, trace angular gravel, very stiff, wet	
MC-7	16.34	21	49				
					SP	Gray POORLY GRADED SAND, trace gravel, pockets of	

LOG OF BORING

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PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000 Job No.: 99106.10

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Plate: A-4A

9106 1-9-00

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 5.0 m.; drilled on 7-28-99

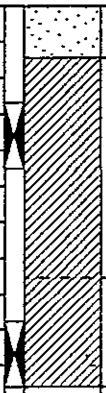
Drilling Method: 20-cm dia. Hollow stem auger
Mobil B-56 rig

BORING NUMBER

B-3

Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.

Sheet 2 of 2



Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Depth (m)	Soil Graph & U.S.C.S.		
					10		clay, sand is coarse grained, subrounded to subangular, dense, wet	
MC-8	15.24	29	18		11	CL	Gray/brown, mottled orange/rust brown LEAN CLAY, trace very fine sand, stiff, wet	pp=75 kPa
MC-9	15.56	27	17		12	CL	Brown LEAN CLAY, stiff, wet	pp=75 kPa LL=36 PI=19
					13		Bottom of drillhole at 12.7 m Groundwater encountered during drilling at 6.1 m	
					14			
					15			
					16			
					17			
					18			
					19			
					20			

LOG OF BORING

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PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000

Job No.: 99106.10

106 1-9-00

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Plate:

A-4B

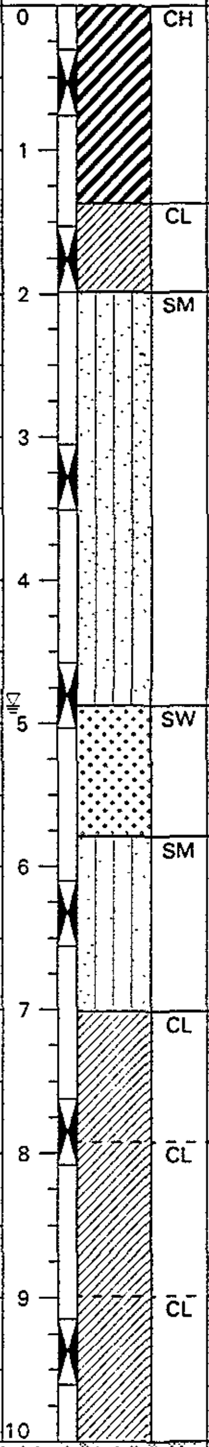
Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 5.0 m.; drilled on 7-29-99

Drilling Method: 20-cm dia. Hollow stem auger
Mobil B-56 rig

BORING NUMBER B-4

Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.

Sheet 1 of 2



Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	U.S.C.S.	Description	
MC-1	17.44	18	16	215	CH	Brown/dark gray FAT CLAY, trace sand and gravel, stiff, damp to moist (Fill)	pp=225 kPa
MC-2	16.97	20	28	268	CL	Brown to dark brown SANDY LEAN CLAY, trace gravel, very stiff, moist (Fill)	pp=225 kPa LL=37 PI=19
MC-3	17.76	14	22		SM	Light gray SILTY SAND, pockets of clay, medium dense, moist	
MC-4	17.76	18	19			Dark greenish brown	
					SW	Brown WELL GRADED SAND, trace gravel, sand is fine to coarse grained, gravel is subrounded to rounded. loose, wet	
MC-5	18.54	17	22		SM	Brown SILTY SAND, trace gravel, clay pockets, medium dense, moist to wet	
					CL	Grayish green LEAN CLAY WITH SAND, sand is coarse grained and angular, trace gravel, hard, wet	
MC-6	17.44	20	62	297	CL	Grayish green LEAN CLAY, trace scattered peat, hard, wet	pp=275 kPa
MC-7	16.66	23	57	239	CL	Light brown, mottled rust brown LEAN CLAY, trace fine gravel, hard, wet	pp=300 kPa LL=39 PI=22

LOG OF BORING

PARIKH CONSULTANTS, INC.
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PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000

Job No.: 99106.10

108 1-3-00

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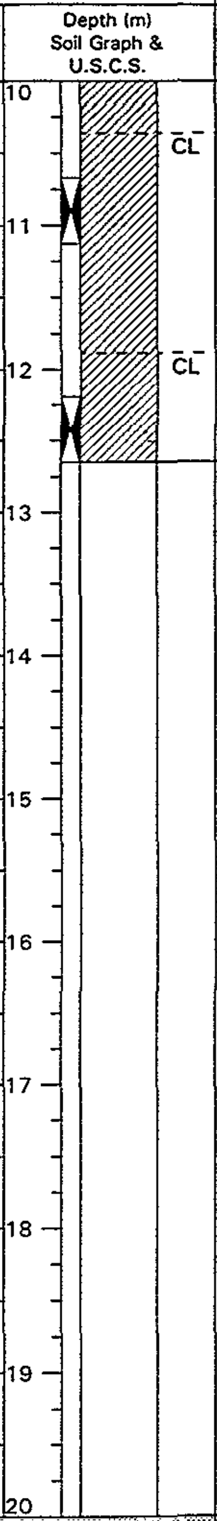
Plate: A-5A

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 5.0 m.; drilled on 7-29-99	**Drilling Method:** 20-cm dia. Hollow stem auger Mobil B-56 rig
BORING NUMBER	**B-4**
Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 2 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Depth (m)	U.S.C.S.	Description	
					10			
						CL		
MC-8	16.03	22	20	38	11		Gray/brown, mottled rust brown LEAN CLAY, stiff, wet	pp=75 kPa
					12	CL	Gray LEAN CLAY, hard, wet	
MC-9	15.56	28	48					pp=25 kPa
							Bottom of drillhole at 12.7 m Groundwater encountered at 4.9 m during drilling	
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20			



LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000 Job No.: 99106.10

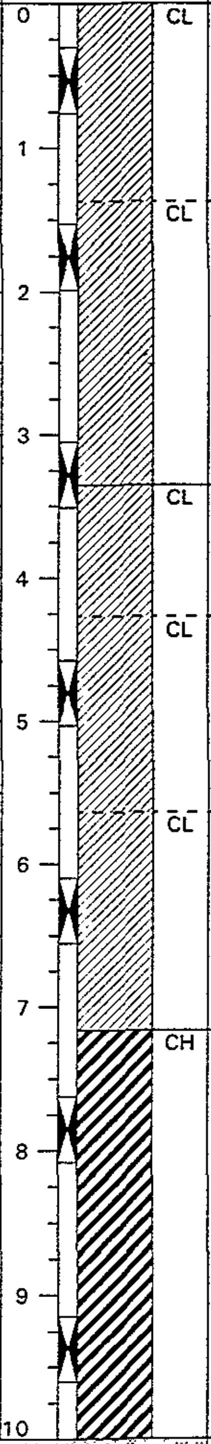
Plate: A-5B

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

106 1-3-00

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 4.2 m.; drilled on 7-29-99	**Drilling Method:** 20-cm dia. Hollow stem auger Mobil B-56 rig	**BORING NUMBER** **B-5**
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 1 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)
MC-1	18.23	10	42	
MC-2	17.76	16	42	
MC-3	15.87	21	9	
MC-4	17.13	21	14	67
MC-5	15.56	28	17	
MC-6	16.19	24	22	
MC-7	16.66	22	33	239



U.S.C.S.	Description	
CL	Dark brown SANDY LEAN CLAY WITH GRAVEL, very stiff, dry, rootlets (Fill)	
CL	Light gray, LEAN CLAY WITH SAND, very stiff (Fill) Dark brown, sand is fine to coarse and angular	
CL	Dark brown LEAN CLAY, trace sand, firm, damp to moist	pp = 250 kPa
CL	Light brown with white coloration, LEAN CLAY, trace sand with concretion, stiff, moist	pp = 75 kPa
CL	Gray/brown with rust mottling, LEAN CLAY, trace fine sand, stiff, moist	pp = 75 kPa
CH	Light brown with white coloration, FAT CLAY, stiff, moist	pp = 250 kPa
	Trace sand and fine gravel, very stiff, moist	pp = 350 kPa

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

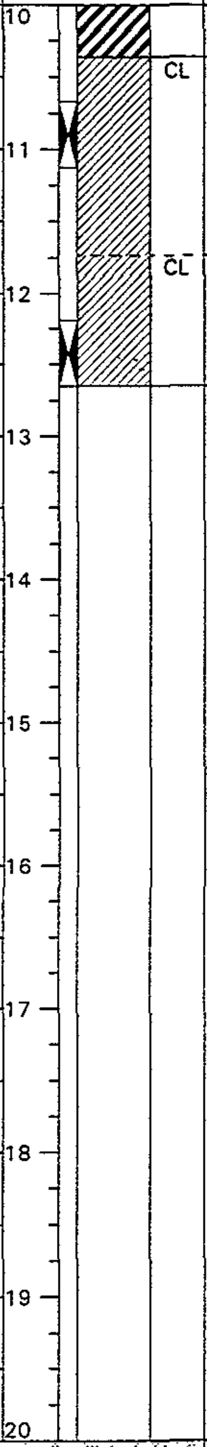
Date: 1/2000 Job No.: 99106.10

108 1-3-00

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-6A

Boring Location, Elevation & Date Drilled:	Drilling Method:	BORING NUMBER
SEE ATTACHED SITE PLAN; Elev. approx. 4.2 m.; drilled on 7-29-99	20-cm dia. Hollow stem auger Mobil B-56 rig	B-5
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 2 of 2



Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Depth (m) Soil Graph & U.S.C.S.		
MC-8	14.46	31	18	57	CL	Grayish brown with rust brown mottled, LEAN CLAY, trace sand, stiff, moist to wet	pp=75 kPa
MC-9	17.60	21	36		CL	Gray/brown with rust brown mottled, LEAN CLAY WITH SAND, trace fine gravel, very stiff	pp=200 kPa
						Bottom of drillhole at 12.7 m No groundwater encountered during drilling	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000
Job No.: 99106.10

)106 1-3-00

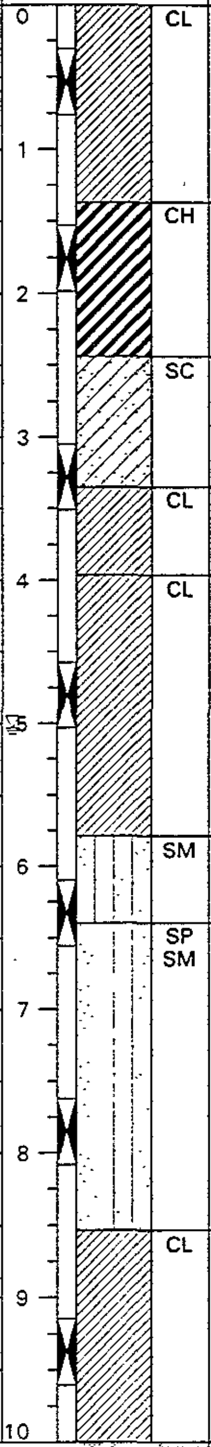
This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate:
A-6B

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 4.4 m.; drilled on 7-29-99	**Drilling Method:** 20-cm dia. Hollow stem auger Mobil B-56 rig	**BORING NUMBER** **B-6**
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 1 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)
MC-1	17.76	10	68	
MC-2	16.97	20	30	
MC-3	15.40	20	38	
MC-4	16.66	21	17	
MC-5	17.13	20	55	
MC-6	-	12	50/10 cm	
MC-7	15.87	24	41	

Depth (m) Soil Graph & U.S.C.S.



U.S.C.S.	Description	
CL	Light brownish/gray LEAN CLAY, trace sand and gravel, hard, damp (Fill)	
CH	Dark brown/olive green FAT CLAY, pieces of concrete up to 13 cm, very stiff, damp (Fill)	
SC	Dark grayish brown CLAYEY SAND WITH GRAVEL, medium dense, damp (Fill)	
CL	Dark gray/black LEAN CLAY, very stiff, damp (Fill)	
CL	Light gray/brown LEAN CLAY, trace sand, stiff, moist	pp=100 kPa
SM	Gray SILTY SAND, medium dense, wet	
SP SM	Gray to dark brown POORLY GRADED SAND WITH SILT, sand is medium grained, medium dense, wet Trace gravel, very dense	
CL	Light brown with rust mottling LEAN CLAY, very stiff, wet	pp=300 kPa LL=45 PI=27

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000
Job No.: 99106.10

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Plate:
A-7A

3108 1-3-00

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 4.4 m.; drilled on 7-29-99	**Drilling Method:** 20-cm dia. Hollow stem auger Mobil B-56 rig	**BORING NUMBER** **B-6**
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 2 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Depth (m)	Soil Graph & U.S.C.S.			
					10	▨	CL	Brown/gray SANDY LEAN CLAY, firm, wet	
MC-8	-	31	13			▨			
					11	▨			
						▨	CL	Yellowish brown with rust mottling LEAN CLAY, some medium grained sand, very stiff, wet	
					12	▨			
MC-9	16.34	24	31			▨			pp = 150 kPa
								Bottom of drillhole at 12.7 m Groundwater encountered at 5.0 m during drilling	
					13				
					14				
					15				
					16				
					17				
					18				
					19				
					20				

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000

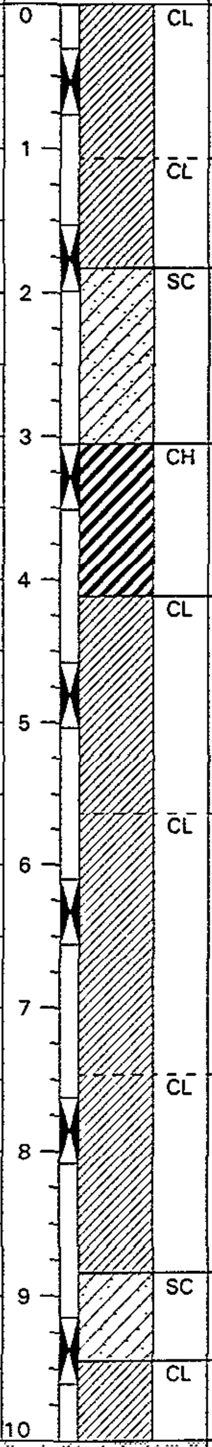
Job No.: 99106.10

106 1-3-00

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate:
A-7B

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 4.6 m.; drilled on 8-5-99	Drilling Method: 20-cm dia. Hollow stem auger Mobil B-40 rig	BORING NUMBER **B-7**
	Sampling Method: *64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs)* hammer, 76 cm (30 inch) drop.	*Sheet 1 of 2*



Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)
MC-1	16.81	10	68	
MC-2	20.27	8	44	
MC-3	15.09	29	38	
MC-4	16.34	29	17	
MC-5	16.03	24	29	
MC-6	16.19	26	18	
MC-7	17.13	22	40	

U.S.C.S.	Description	
CL	Light brown/gray LEAN CLAY WITH SAND, trace gravel, sand is very fine grained, hard, dry (Fill)	
CL	Greenish gray mottled with light brown, SANDY LEAN CLAY, very stiff, dry (Fill)	
SC	Dark brown CLAYEY SAND WITH GRAVEL, medium dense, dry (Fill)	
CH	Dark gray FAT CLAY, trace organics, very stiff, damp to moist (Fill)	pp = 175 kPa
CL	Brown/dark gray SANDY LEAN CLAY, trace gravel, stiff, moist	pp = 250 kPa
CL	Light gray, mottled rust brown LEAN CLAY, trace coarse sand, very stiff, moist	pp = 225 kPa
CL	Light brown/gray, mottled rust LEAN CLAY, trace sand and gravel, stiff, moist	pp = 75 kPa
SC	Brown CLAYEY SAND, coarse grained, medium dense, wet	
CL	Brown gray, rust brown mottled LEAN CLAY, very stiff, wet	pp = 350 kPa

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000 Job No.: 99106.10

Plate: A-8A

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for omplete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may ffer at other locations and may change at this location with the passage of time. The data presented is a simplification of actual onditions encountered.

1106 1-3-00

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 4.6 m.; drilled on 8-5-99	Drilling Method: 20-cm dia. Hollow stem auger Mobil B-40 rig	**BORING NUMBER** **B-7**
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 2 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Depth (m)	U.S.C.S.	Description	
					10	SP SM	Gray POORLY GRADED SAND WITH SILT, very dense, wet	
MC-8	17.60	17	50/12.5 cm					
					11			
						CL	Greenish gray mottled with light brown LEAN CLAY, very stiff	
					12			
MC-9	15.24	27	25					pp = 75 kPa
							Bottom of drillhole at 12.7 m No groundwater encountered during drilling	
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20			

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000
Job No.: 99106.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate:
A-8B

Boring Location, Elevation & Date Drilled:
SEE ATTACHED SITE PLAN; Elev. approx. 2.7 m.; drilled on 7-29-99

Drilling Method:
20-cm dia. Hollow stem auger
Mobil B-56 rig

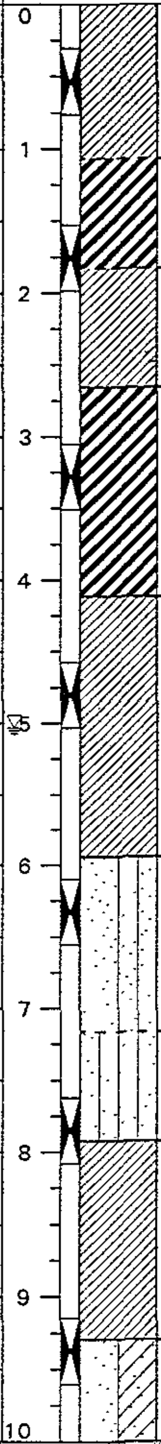
BORING NUMBER
B-8

Sampling Method:
64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.

Sheet 1 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)
MC-1	18.86	13	56	
MC-2	16.66	20	43	
MC-3	18.23	14	38	
MC-4	16.97	21	18	81
MC-5	17.13	15	50/15 cm	
MC-6	17.60	20	47	
MC-7	18.07	16	65	

Depth (m) Soil Graph & U.S.C.S.



U.S.C.S.	Description	
CL	Dark gray/brown SANDY LEAN CLAY WITH GRAVEL, gravel up to 25 mm, subangular, hard, dry to damp (Fill)	
CH	Dark gray/brown FAT CLAY, trace sand and gravel, very stiff, damp (Fill)	pp = 350 kPa
CL	Grayish brown SANDY LEAN CLAY, trace gravel, very stiff, damp (Fill)	
CH	Dark gray FAT CLAY, very stiff, damp	pp = 400 kPa
CL	Light brown/gray, mottled with brown LEAN CLAY, trace sand and gravel, stif, moist to wet	pp = 125 kPa
SP SM	Gray POORLY GRADED SAND WITH SILT, medium to coarse grained sand, pockets of clay, dense, wet	
SM	Dark gray SILTY SAND, sand is coarse grained, trace fine gravel, medium dense, wet	+#4 = 8% -#200 = 34%
CL	Light brown SANDY LEAN CLAY, very stiff, moist	pp = 100 kPa
SP SC	Yellowish brown POORLY GRADED SAND WITH CLAY, sand is medium grained, trace gravel, dense, wet	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

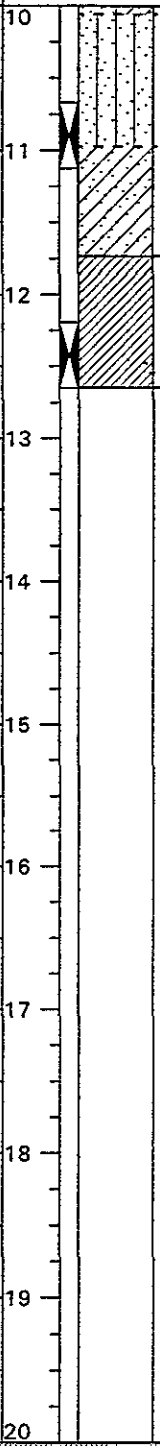
Date: 1/2000
Job No.: 99106.10

106 1-9-00

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate:
A-9A

Boring Location, Elevation & Date Drilled:	Drilling Method:	BORING NUMBER
SEE ATTACHED SITE PLAN; Elev. approx. 2.7 m.; drilled on 7-29-99	20-cm dia. Hollow stem auger Mobil B-56 rig	**B-8**
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 2 of 2



Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Depth (m)	U.S.C.S.		
					10	SM	Light brown SILTY SAND, pockets of clay, medium dense, wet	
MC-8	16.19	25	25	34				
					11	SC	Brown CLAYEY SAND, sand is fine grained, medium dense, wet	
						CL	Yellowish brown/gray, mottled rust LEAN CLAY, very stiff, moist	
					12			
MC-9	14.77	28	36					pp=300 kPa
							Bottom of drillhole at 12.7 m Groundwater encountered at 5.0 m during drilling	
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20			

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000
Job No.: 99106.10

106 1-9-00

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate:
A-9B

Boring Location, Elevation & Date Drilled:
SEE ATTACHED SITE PLAN; Elev. approx. 2.5 m.; drilled on 8-5-99

Drilling Method:
20-cm dia. Hollow stem auger
Mobil B-40 rig

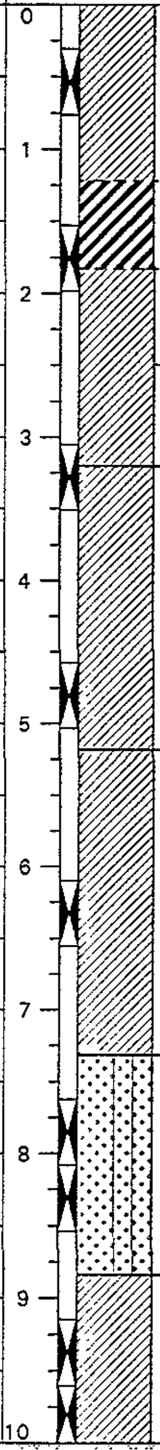
BORING NUMBER
B-9

Sampling Method:
64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.

Sheet 1 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)
MC-1	18.54	14	48	551
MC-2	18.07	18	15	
MC-3	17.76	18	34	
MC-4	15.40	14	34	43
MC-5	16.97	22	28	105
MC-6			33	
MC-7	18.54	11	44	
MC-8			49	
MC-9	16.50	24	53	

Depth (m) Soil Graph & U.S.C.S.



U.S.C.S.	Description	
CL	Brown to grayish brown LEAN CLAY, trace sand and gravel, hard, dry to damp (Fill)	
CH	Brown/gray SANDY FAT CLAY, stiff, dry to damp (Fill)	
CL	Yellowish brown/gray, mottled rust brown LEAN CLAY, trace coarse sand, stiff (Fill)	pp=200 kPa
CL	Dark gray to yellowish brown SANDY LEAN CLAY, very stiff, damp Trace gravel, very stiff	pp=325 kPa
CL	Light gray/brown LEAN CLAY WITH SAND, trace gravel, very stiff, moist	pp=125 kPa
SW SM	(no recovery) Gray WELL GRADED SAND WITH SILT, trace gravel, pockets of clay, medium dense	+#4=0% -#200=5%
CL	(no recovery) Gray/brown LEAN CLAY, hard, moist to wet	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000
Job No.: 99106.10

106 1-9-00

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Plate:
A-10A

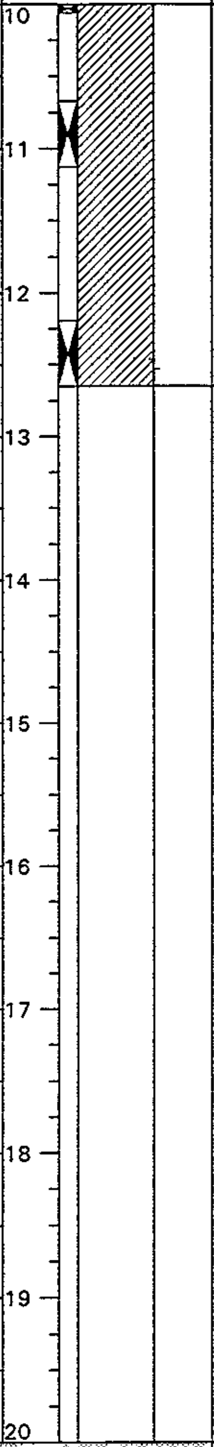
Boring Location, Elevation & Date Drilled:
SEE ATTACHED SITE PLAN; Elev. approx. 2.5 m.; drilled on 8-5-99

Drilling Method:
20-cm dia. Hollow stem auger
Mobil B-40 rig

BORING NUMBER
B-9

Sampling Method:
64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.

Sheet 2 of 2



Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Depth (m)	Description	
					10		pp=175 kPa
MC-10	15.87	25	48	230			
					11	Yellowish brown	pp=275 kPa
MC-11	16.03	27	31		12	Trace fine gravel, very stiff	pp=75 kPa
					13	Bottom of drillhole at 12.7 m No groundwater encountered during drilling	

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000
Job No.: 99106.10

Plate: A-10B

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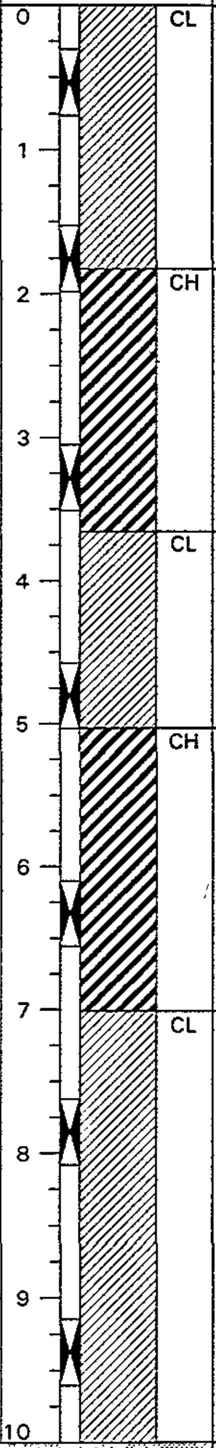
106 1-9-00

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 4.5 m.; drilled on 8-5-99	**Drilling Method:** 20-cm dia. Hollow stem auger Mobil B-40 rig	**BORING NUMBER** **B-10**
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 1 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)
MC-1	19.17	10	35	479
MC-2	16.50	18	37	
MC-3	15.56	24	49	
MC-4	15.09	28	15	
MC-5	12.57	41	15	
MC-6	15.24	26	44	144
MC-7	19.33	16	52	77

Depth (m) Soil Graph & U.S.C.S.



U.S.C.S.	Description	
CL	Light brown LEAN CLAY WITH SAND, trace fine gravel up to 13 mm, sand is fine to coarse, roots, very stiff, dry to damp (Fill)	
CH	Dark gray to black FAT CLAY, very stiff, damp (Fill)	
	Gray to grayish brown, trace subrounded gravel, hard	pp = 350 kPa
CL	Grayish brown SANDY LEAN CLAY, trace roots, stiff, moist (Fill)	pp = 100 kPa LL = 32 PI = 15
CH	Gray FAT CLAY, stiff, moist	pp = 50 kPa
CL	Gray/yellowish brown, mottled rust LEAN CLAY, very stiff, moist	pp = 350 kPa
	Lense of coarse sand between 9.5 and 9.6 m, hard	pp = 250 kPa LL = 41 PI = 24

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000 Job No.: 99106.10

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Plate: A-11A

Boring Location, Elevation & Date Drilled:
SEE ATTACHED SITE PLAN; Elev. approx. 4.5 m.; drilled on 8-5-99

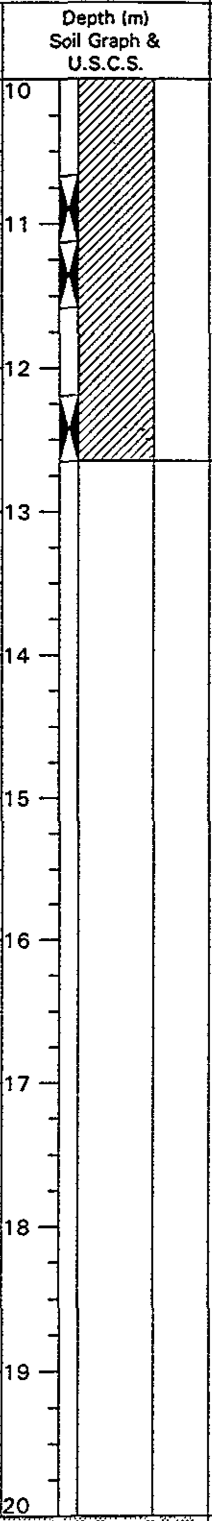
Drilling Method:
20-cm dia. Hollow stem auger
Mobil B-40 rig

BORING NUMBER
B-10

Sampling Method:
64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.

Sheet 2 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Description	
MC-8			37		(no recovery)	
MC-9	15.09	29	42			pp=50 kPa
					Trace sand, very stiff	
MC-10	16.34	21	51	192	Hard	pp=250 kPa
					Bottom of drillhole at 12.7 m No groundwater encountered during drilling	



LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000

Job No.: 99106.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate:
A-11B

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 4.2 m.; drilled on 9-22-99	Drilling Method: 20-cm dia. Hollow stem auger Mobil B-40 rig	BORING NUMBER **B-11**
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 1 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Depth (m)	Soil Graph & U.S.C.S.	Description	
MC-1	18.07	17	39		0	CL	Brown LEAN CLAY, occasional sand and gravel, very stiff, dry (Fill)	
MC-2	13.04	33	34		1 2	CH	Dark gray FAT CLAY, pockets of lean clay, very stiff, moist (Fill)	pp = 175 kPa
MC-3	16.19	24	42	201	3		Dark gray, occasional gravel, very stiff, moist	pp = 300 kPa
MC-4	16.19	25	31		4 5	CL	Dark gray, mottled with brown and light greenish gray LEAN CLAY, occasional fine gravel, very stiff, moist (Fill)	pp = 150 kPa
MC-5	8.96	68	14	67	6 7	OH	Dark gray ORGANIC CLAY, stiff, moist	pp = 150 kPa LL = 119 PI = 81
MC-6	16.66	24	22		8	CL	Light greenish gray SANDY LEAN CLAY, occasional gravel, stiff, moist	pp = 50 kPa
MC-7	16.34	23	43		9 10	CL	Brown mottled with yellow and gray LEAN CLAY, occasional gravel, very stiff, moist Lense of clayey sand at 9.3 m, sand is coarse grained	pp = 350 kPa

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

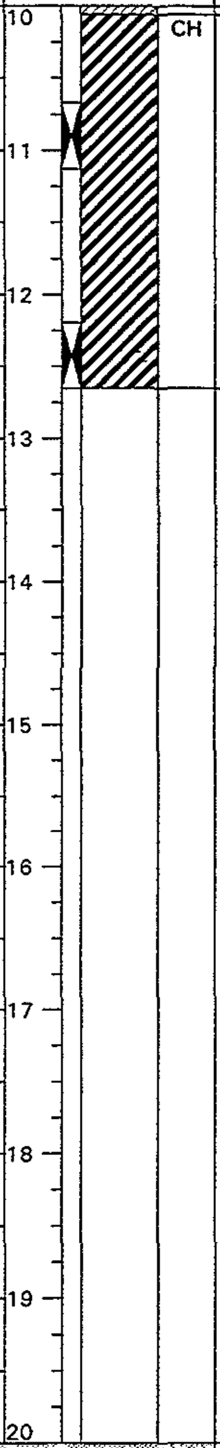
Date: 1/2000 | Job No.: 99106.10

Plate: A-12A

106 1-3-00

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Boring Location, Elevation & Date Drilled: SEE ATTACHED SITE PLAN; Elev. approx. 4.2 m.; drilled on 9-22-99	**Drilling Method:** 20-cm dia. Hollow stem auger Mobil B-40 rig	**BORING NUMBER** B-11
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 2 of 2



Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Depth (m) Soil Graph & U.S.C.S.		
					10	Brown FAT CLAY, hard, moist	
MC-8	15.40	27	69				
					11		pp = 350 kPa
					12		
MC-9	15.71	26	55			Trace coarse sand, occasional gravel, hard	pp = 225 kPa
						Bottom of drillhole at 12.7 m No groundwater encountered during drilling	
					13		
					14		
					15		
					16		
					17		
					18		
					19		
					20		

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000
Job No.: 99106.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate: A-12B

Boring Location, Elevation & Date Drilled:
SEE ATTACHED SITE PLAN; Elev. approx. 4.2 m.; drilled on 9-22-99

Drilling Method:
20-cm dia. Hollow stem auger
Mobil B-40 rig

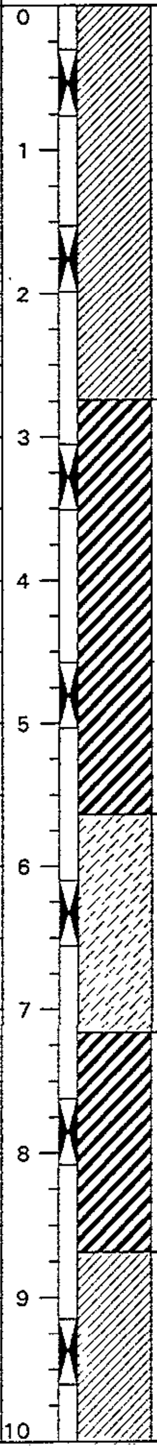
BORING NUMBER
B-12

Sampling Method:
64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.

Sheet 1 of 2

Sample Type & No.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)
MC-1	17.13	18	29	
MC-2	17.91	15	38	
MC-3	13.67	33	24	129
MC-4	9.90	51	9	38
MC-5	8.33	73	10	48
MC-6	14.46	30	25	
MC-7	13.51	31	25	

Depth (m) Soil Graph & U.S.C.S.



U.S.C.S.	Description	
CL	Brown LEAN CLAY, trace sand and fine gravel, very stiff, damp (Fill)	
	Pocket of dark gray fat clay at 0.8 m	pp=350 kPa
	Brown/greenish gray, trace gravel up to 38 mm, piece of sandstone up to 25 mm, very stiff	PP=400 kPa LL=30 PI=12
CH	Dark gray FAT CLAY, very stiff, moist (Fill)	pp=270 kPa
	Dark gray/black, pockets of clayey sand, firm, moist	pp=50 kPa
OH	Dark gray ORGANIC CLAY, firm, moist	pp=50 kPa LL=109 PI=72
CH	Dark gray FAT CLAY, very stiff, moist	
	Changes to light greenish gray at bottom of sample, trace sand	pp=125 kPa
CL	Light greenish gray SANDY LEAN CLAY, very stiff, moist	pp=200 kPa

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000

Job No.: 99106.10

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for complete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Plate:
A-13A

Boring Location, Elevation & Date Drilled:	Drilling Method:	BORING NUMBER
SEE ATTACHED SITE PLAN; Elev. approx. 4.2 m.; drilled on 9-22-99	20-cm dia. Hollow stem auger Mobil B-40 rig	**B-12**
	Sampling Method: 64 mm I.D. Mod. Calif. (MC), 64 kg (140 lbs) hammer, 76 cm (30 inch) drop.	Sheet 2 of 2

Sample Type & o.	Dry Density (kN/m3)	Water Content (%)	Blows Per 30 cm	Compress. Strength (kPa)	Depth (m) Soil Graph & U.S.C.S.		
					10 CL	Brown mottled with gray LEAN CLAY, hard, moist	
MC-8	15.87	20	50		11		pp = 300 kPa
					CH	Brown/gray FAT CLAY, very stiff, moist	
MC-9	14.30	26	30		12		pp = 175 kPa
					13	Bottom of drillhole at 12.7 m No groundwater encountered during drilling	
					14		
					15		
					16		
					17		
					18		
					19		
					20		

LOG OF BORING

PARIKH CONSULTANTS, INC.
Geotechnical & Materials Engineering

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

Date: 1/2000
Job No.: 99106.10

Plate: A-13B

This log is part of the report prepared by Parikh Consultants, Inc. for the named project and should be read together with that report for lete interpretation. This summary applies only at the location of this boring and at the time of drilling. Subsurface conditions may at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

MLB2 106 1-3-00

APPENDIX B

APPENDIX B

LABORATORY TESTS

Classification Tests

The field classification of the samples was visually verified in the laboratory according to the Unified Soil Classification System. The results are presented on "Log of Borings", Appendix A.

Moisture-Density

The natural moisture contents and dry unit weights were determined for selected undisturbed samples of the soils in general accordance with ASTM Test Method D 2216-92. This information was used to classify and correlate the soils. The results are presented at the appropriate depths on the "Log of Borings", Appendix A.

Atterberg Limits

The Atterberg Limits were determined for selected samples of the fine-grained materials. These results were used to classify the soils, as well as to obtain an indication of the expansion potential with variations in moisture content. The Atterberg Limits were determined in general accordance with ASTM Test Method D 4318-93. The results of these tests are presented on Plate B-2, "Plasticity Chart".

Grain Size Classification

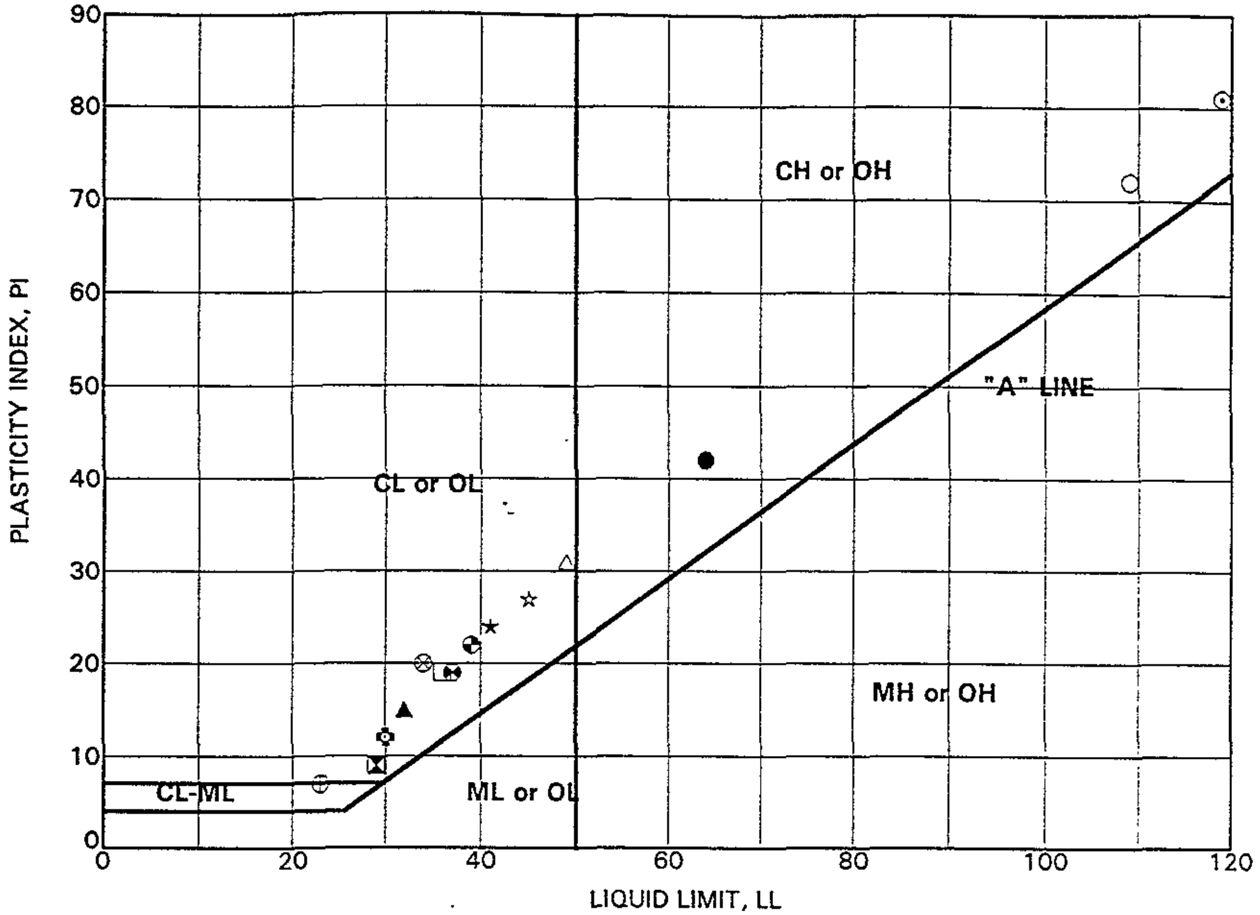
Grain size classification tests (ASTM Test Method D 422-63) were performed on selected samples of granular soil to aid in the classification. The results are presented on Plates B-3A to B-3B, "Grain Size Distribution Curves".

Unconfined Compression Tests

Strength tests were performed on selected undisturbed sample using unconfined compression machine. Unconfined compression test was performed in general accordance with ASTM Test Method D 2166-91. The results are presented on "Log of Borings", Appendix A.

Triaxial Tests

Triaxial tests were performed on selected soil samples in general accordance with relevant ASTM standards. The tests were performed under consolidated undrained conditions and the pore water pressures generated during testing were measured. The tests results are presented on Plates B-4A to B-4J



PLASTICITY CHART

Boring Number	Sample Number	Depth (m)	Test Symbol	Moisture Content (%)	LL	PL	PI	Description
B-1	MC-2	1.7	●	24	64	22	42	FAT CLAY (CH)
B-1	MC-4	4.9	⧗	26	29	20	9	LEAN CLAY (CL)
B-10	MC-4	4.7	▲	28	32	17	15	LEAN CLAY (CL)
B-10	MC-7	9.4	★	16	41	17	24	LEAN CLAY (CL)
B-11	MC-5	6.2	⊙	68	119	38	81	ORGANIC CLAY (OH)
B-12	MC-2	1.7	✪	15	30	18	12	LEAN CLAY (CL)
B-12	MC-5	6.2	○	73	109	37	72	ORGANIC CLAY (OH)
B-2	MC-2	1.8	△	20	49	18	31	LEAN CLAY (CL)
B-2	MC-7	9.3	⊗	14	34	14	20	LEAN CLAY (CL)
B-3	MC-3	3.4	⊕	14	23	16	7	SILTY CLAY (CL-ML)
B-3	MC-9	12.3	□	27	36	17	19	LEAN CLAY (CL)
B-4	MC-2	1.7	⊖	20	37	18	19	LEAN CLAY (CL)
B-4	MC-7	9.3	◕	23	39	17	22	LEAN CLAY (CL)
B-6	MC-7	9.3	☆	24	45	18	27	LEAN CLAY (CL)

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MOUNTAIN VIEW, CA

JOB NO: 99106.10

PLATE NO: B-2

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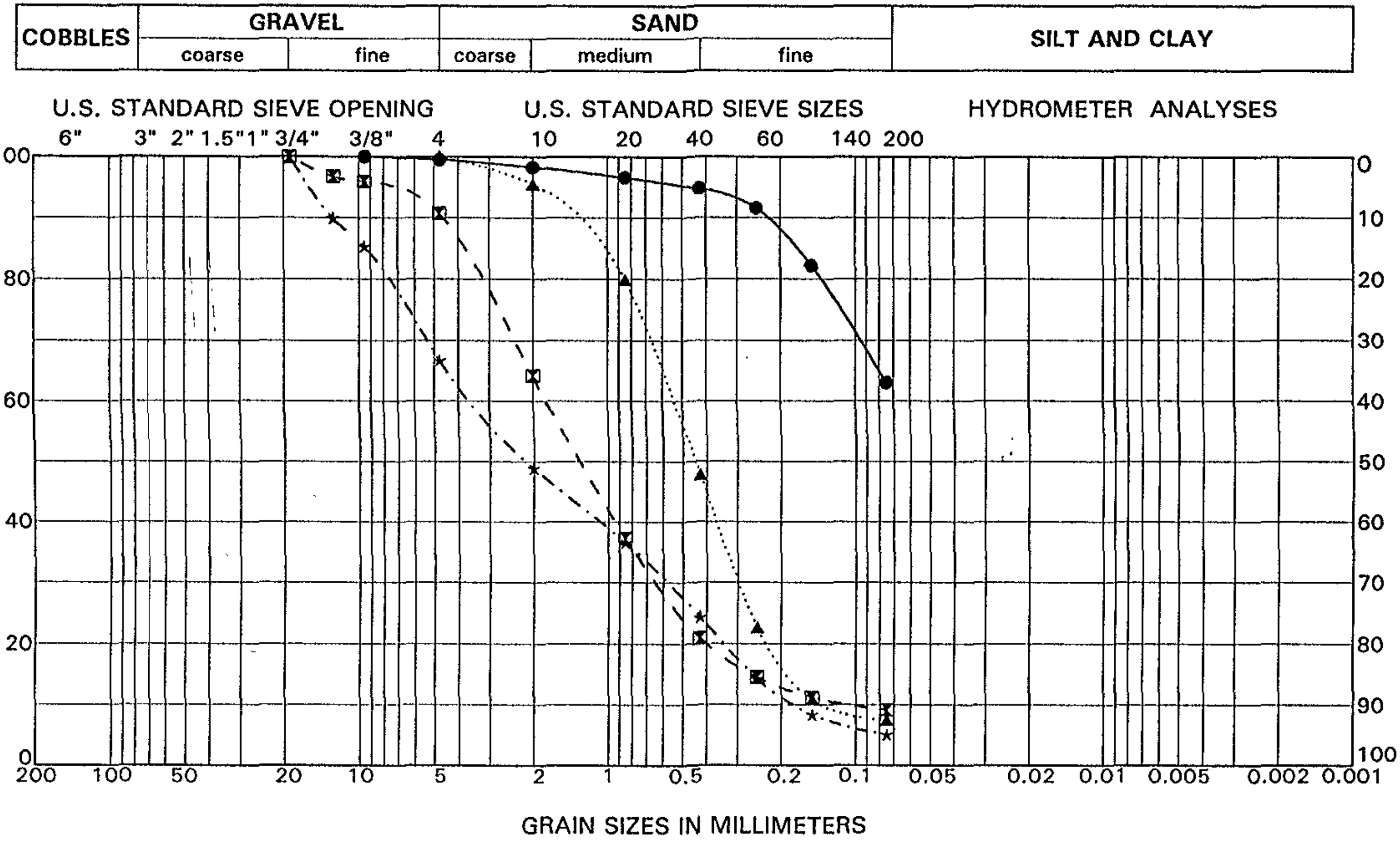
PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
MOUNTAIN VIEW, CA

JOB NO: 99106.10

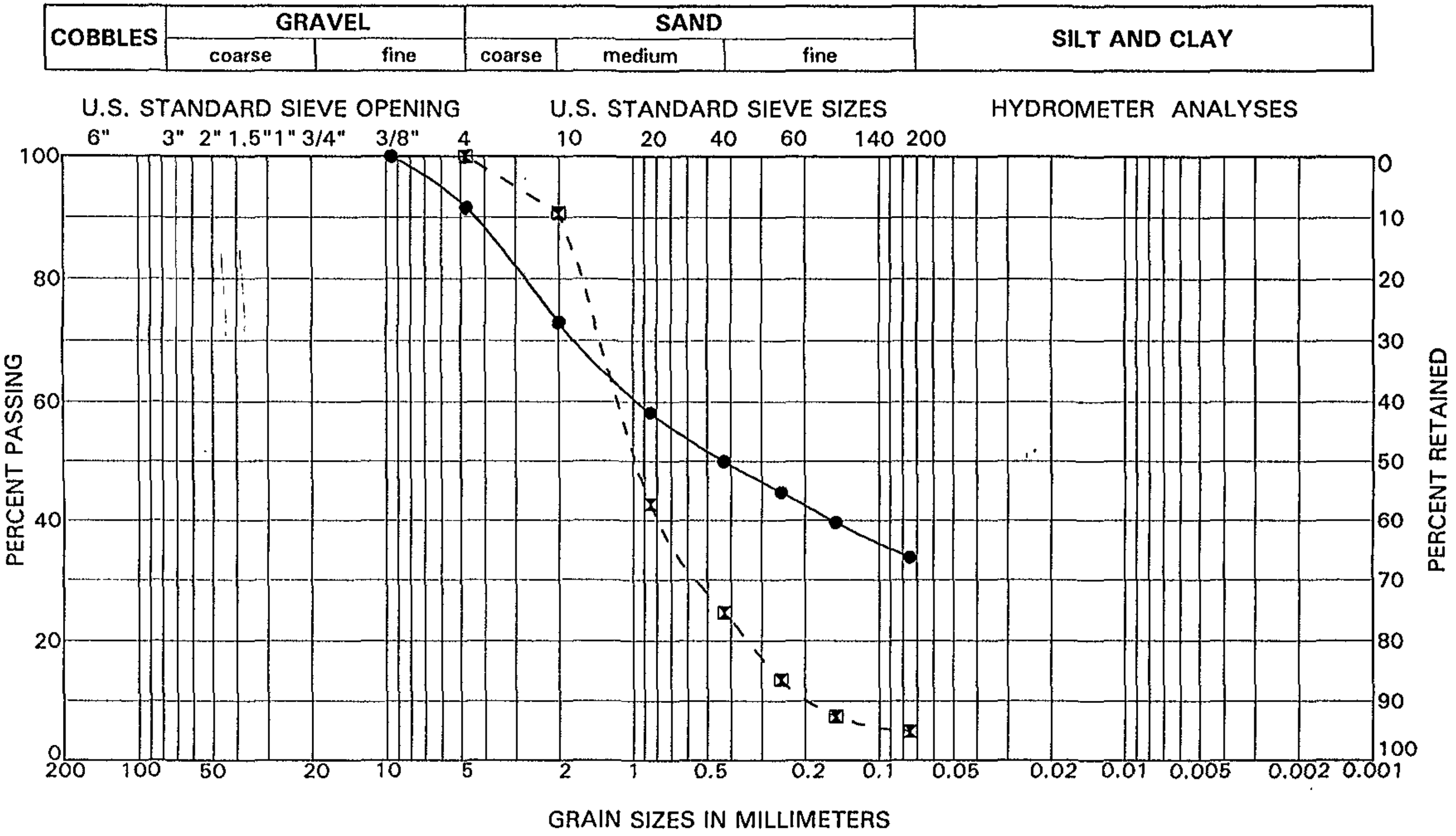
PLATE NO: B-3A

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (m)	Symbol	LL	PI	Description
B-1	MC-5	6.2	●			SANDY SILT (ML)
B-1	MC-8	11.0	⊠			POORLY GRADED SAND WITH CLAY (SP-SC)
B-2	MC-5	6.4	▲			POORLY GRADED SAND WITH SILT (SP-SM)
B-3	MC-4	4.9	★			WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)

GRAIN SIZE DISTRIBUTION CURVES



Boring Number	Sample Number	Depth (m)	Symbol	LL	PI	Description
B-8	MC-6	7.8	●			SILTY SAND (SM)
B-9	MC-7	8.2	☒			WELL GRADED SAND WITH SILT (SW-SM)

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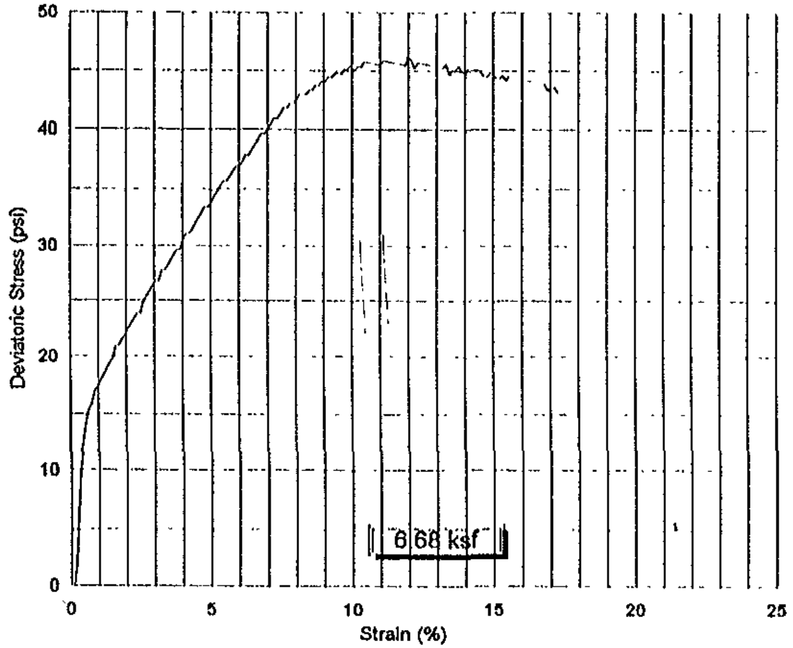
MOUNTAIN VIEW, CA

JOB NO: 99106.10

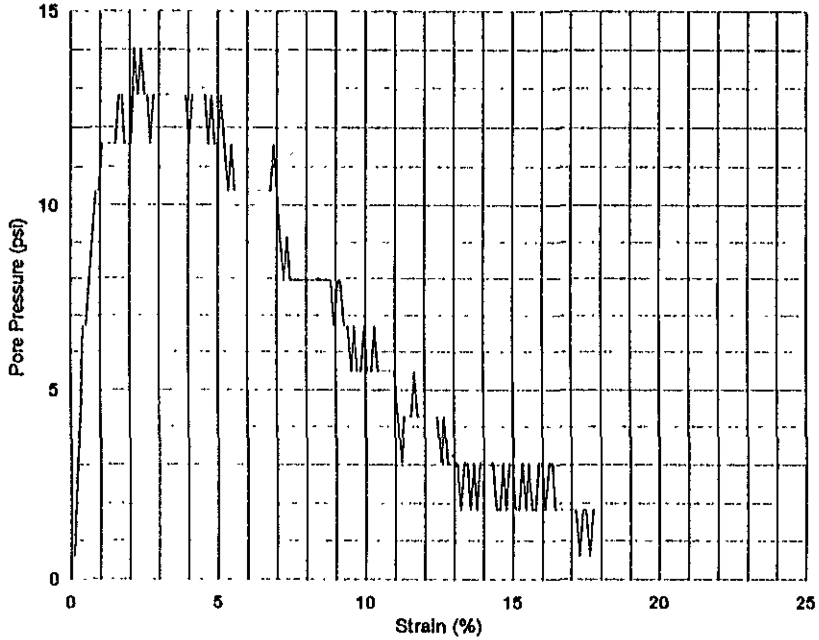
PLATE NO: B-3B

CONSOLIDATED ~~UNCONFINED~~ COMPRESSION TEST
UNDRAINED

STRESS V/S STRAIN



PORE PRESSURE V/S STRAIN



Height of Sample (inch)	5	Cell Pressure (psi)	20
Initial Diameter (inch)	2.416	Back Pressure (psi)	25
% Moisture - Before Test	- -	Maximum Strength (psi))	46.37
% Moisture - After Test	16.3	Strain @ Failure (%)	11.99
Dry Density (pcf)	114.9	Pore Pressure @Failure (psi)	4.28

sigma3' (psi)= 15.72

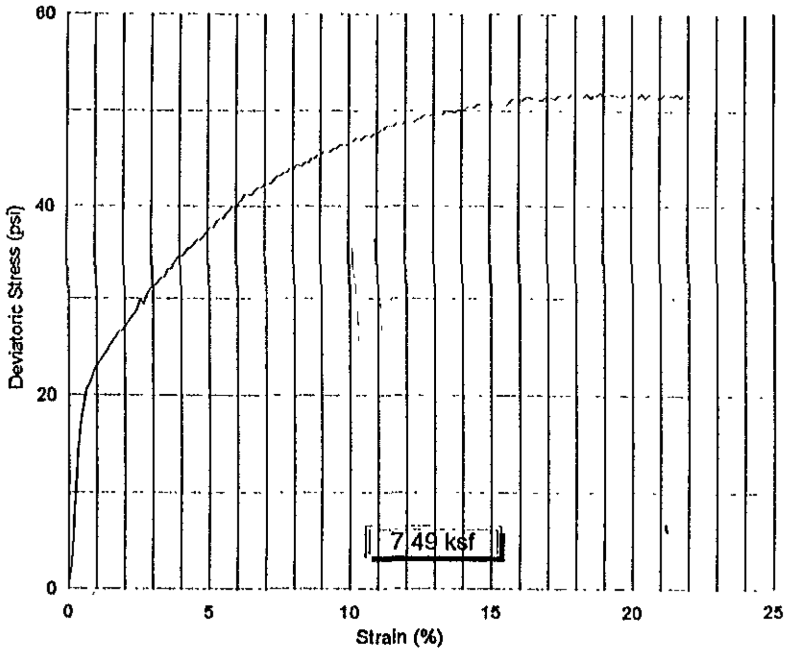
sigma1' (psi)= 62.09

Boring No.	B1	**Sample No.**	3B	**Elev. or Depth (ft)**	11
Job Name :	Permanente Creek Study	**Job No.:**	999106.10	**PLATE NO.:**	B-4A

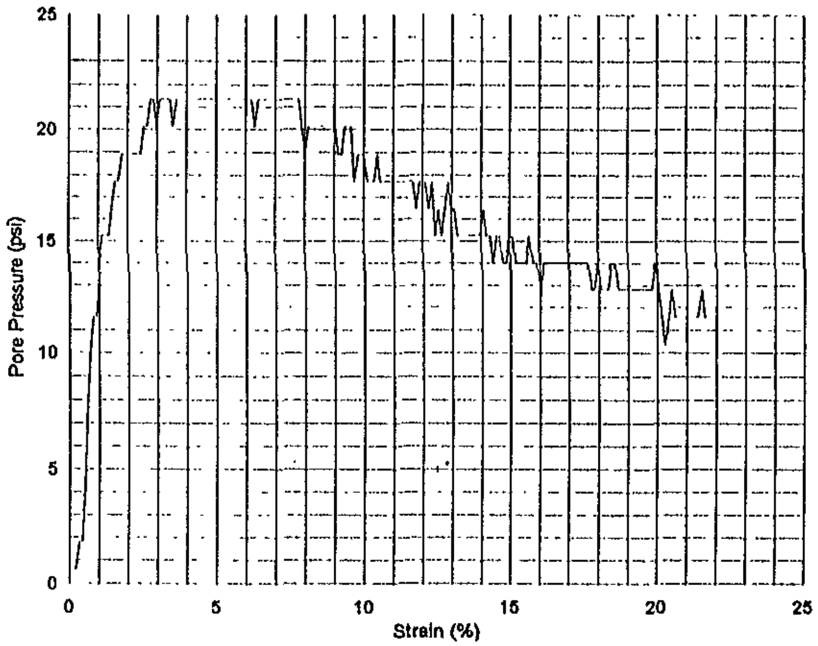
CONSOLIDATED ~~UNCONFINED~~ COMPRESSION TEST

UNDRAINED

STRESS V/S STRAIN



PORE PRESSURE V/S STRAIN



Height of Sample (inch)	5	Cell Pressure (psi)	30
Initial Diameter (inch)	2.416	Back Pressure (psi)	25
% Moisture - Before Test	26.9	Maximum Strength (psi))	52.02
% Moisture - After Test	22.4	Strain @ Failure (%)	19.22
Dry Density (pcf)	98.4	Pore Pressure @Failure (psi)	12.82
sigma3' (psi)=	17.18	sigma1' (psi)=	69.20

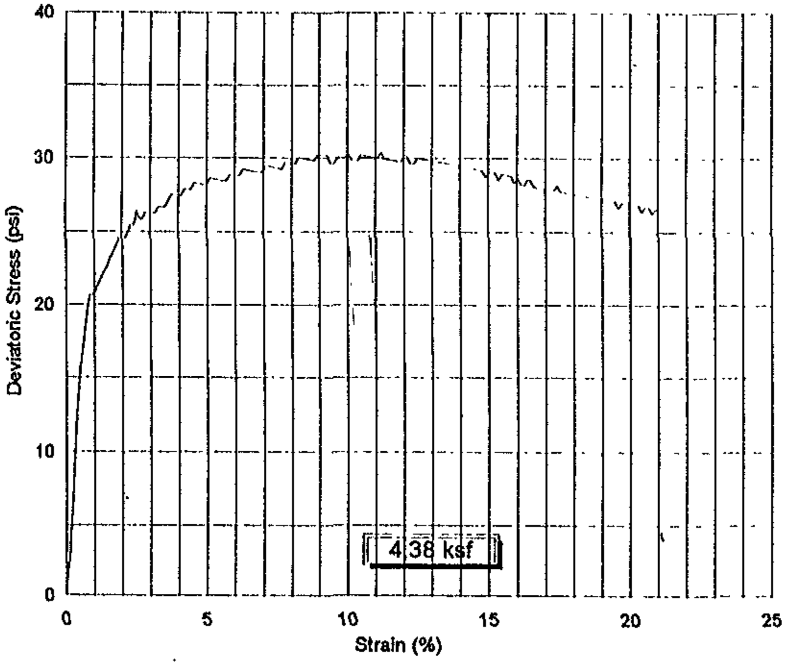
Boring No. B1 **Sample No.** 4B **Elev. or Depth (ft)** 16

Job Name : Permanente Creek Study **Job No.:** 999106.10 **PLATE NO.:** B-4B

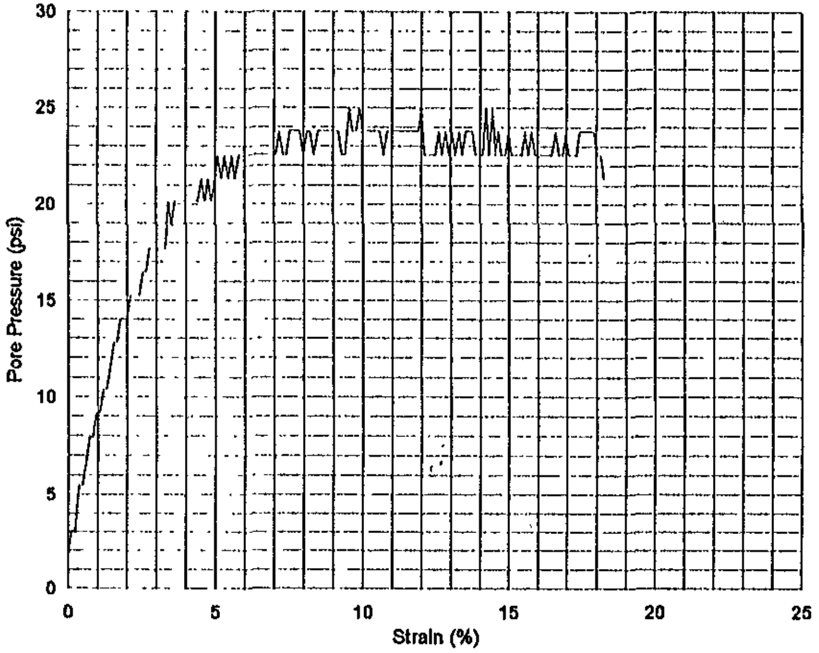
CONSOLIDATED ~~UNCONFINED~~ COMPRESSION TEST

UNDRAINED

STRESS V/S STRAIN



PORE PRESSURE V/S STRAIN



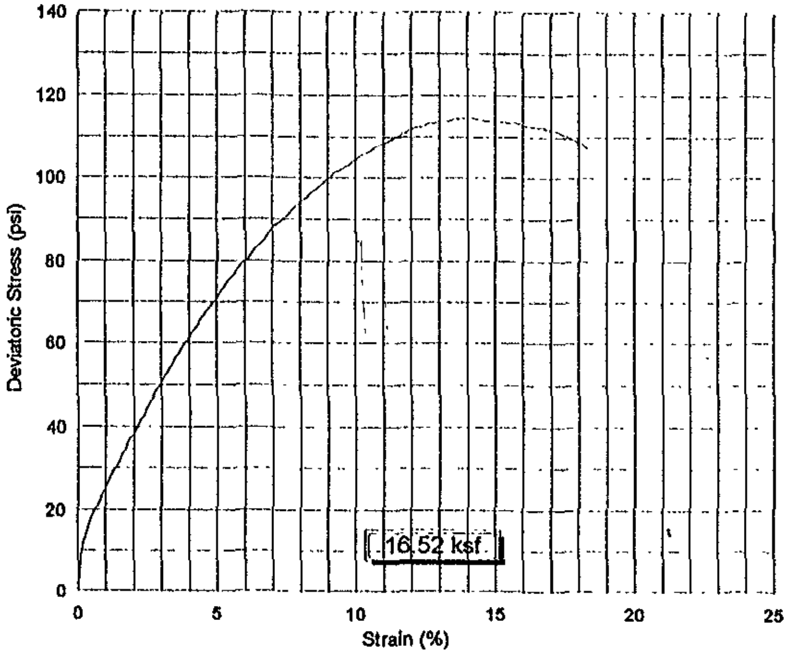
Height of Sample (inch)	5	Cell Pressure (psi)	35
Initial Diameter (inch)	2.416	Back Pressure (psi)	25
% Moisture - Before Test	29.2	Maximum Strength (psi))	30.45
% Moisture - After Test	22.2	Strain @ Failure (%)	13.28
Dry Density (pcf)	94.7	Pore Pressure @Failure (psi)	23.8
sigma3' (psi)=	11.2	sigma1' (psi)=	41.65

Boring No. B3 **Sample No.** 9A **Elev. or Depth (ft)** 40.5

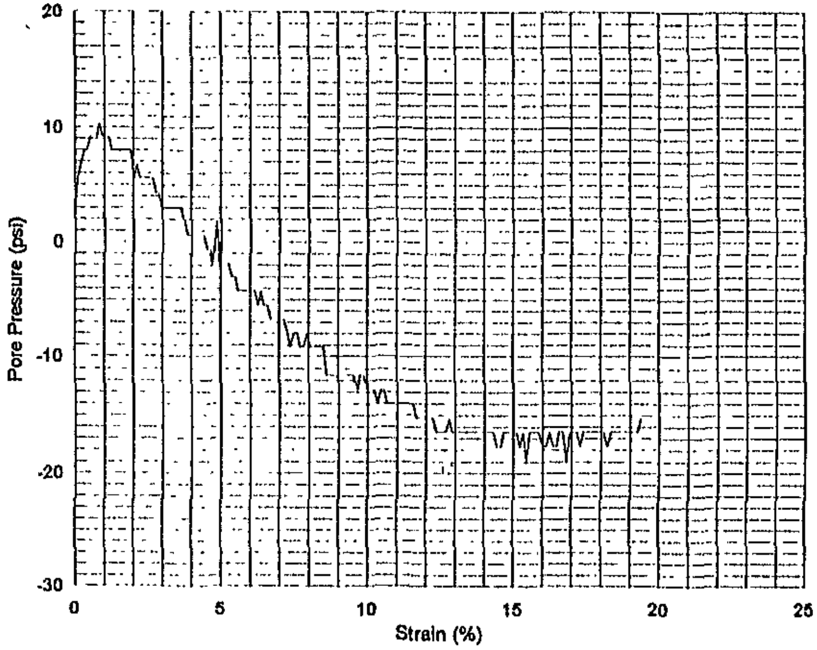
Job Name : Permanente Creek Study **Job No.:** 999106.10 **PLATE NO.:** B-4C

CONSOLIDATED ~~UNCONFINED~~ UNDRAINED COMPRESSION TEST

STRESS V/S STRAIN



PORE PRESSURE V/S STRAIN



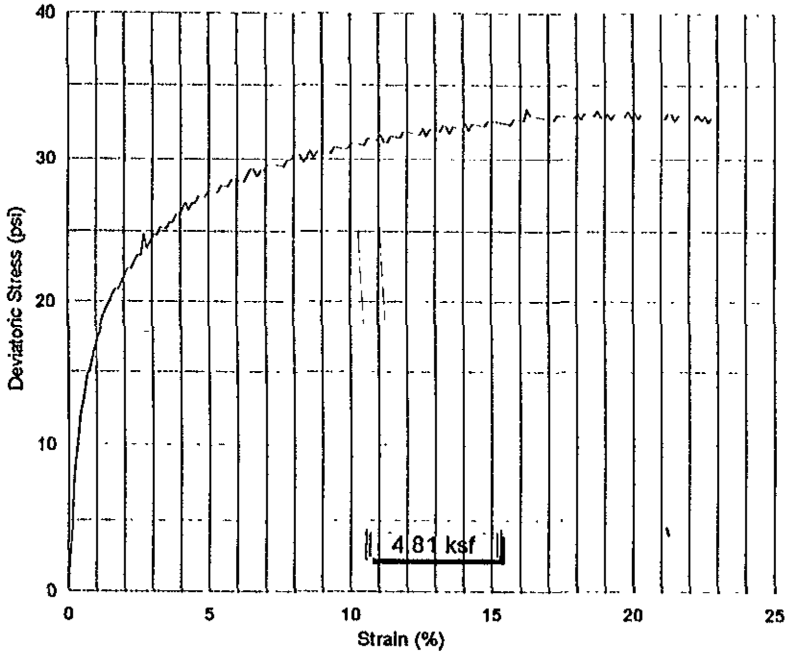
Height of Sample (inch)	5	Cell Pressure (psi)	20
Initial Diameter (inch)	2.416	Back Pressure (psi)	25
% Moisture - Before Test	18.2	Maximum Strength (psi))	114.75
% Moisture - After Test	18.8	Strain @ Failure (%)	14.10
Dry Density (pcf)	114.1	Pore Pressure @Failure (psi)	0
sigma3' (psi)=	36.46	sigma1' (psi)=	151.21

Boring No. B4 **Sample No.** 5A **Elev. or Depth (ft)** 20.5

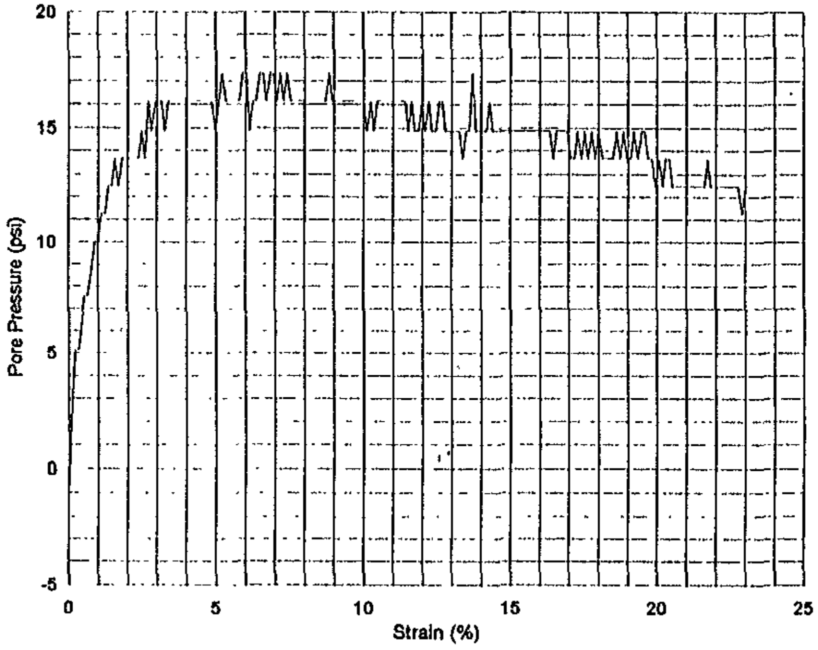
Job Name : Permanente Creek Study **Job No.:** 999106.10 **PLATE NO.:** B-4D

CONSOLIDATED ~~UNCONFINED~~ UNDRAINED COMPRESSION TEST

STRESS V/S STRAIN



PORE PRESSURE V/S STRAIN



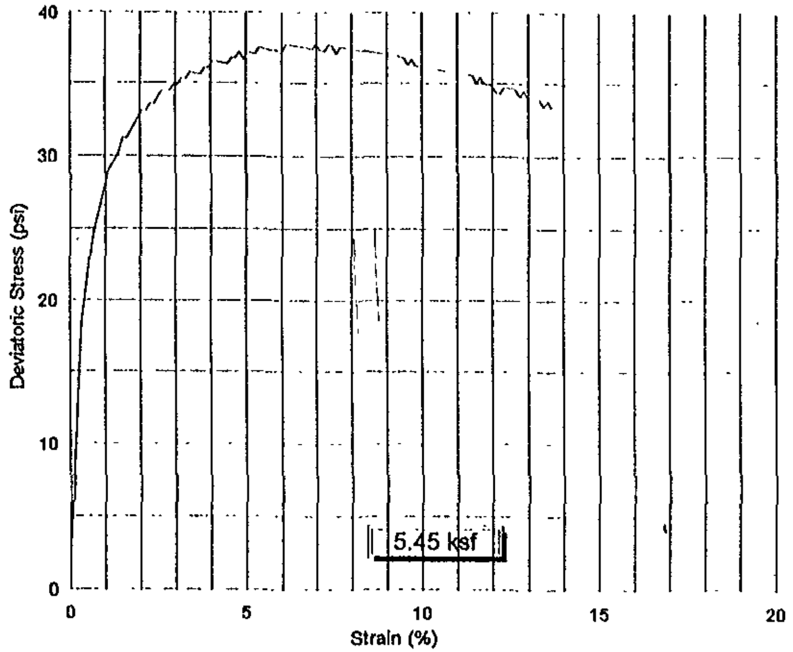
Height of Sample (inch)	5	Cell Pressure (psi)	20
Initial Diameter (inch)	2.416	Back Pressure (psi)	40
% Moisture - Before Test	25.5	Maximum Strength (psi))	33.43
% Moisture - After Test	25.5	Strain @ Failure (%)	16.24
Dry Density (pcf)	99.1	Pore Pressure @Failure (psi)	14.9
sigma3' (psi)=	5.1	sigma1' (psi)=	38.53

Boring No. B5 **Sample No.** 6A **Elev. or Depth (ft)** 25.5

Job Name : Permanente Creek Study **Job No.:** 999106.10 **PLATE NO.:** B-4E

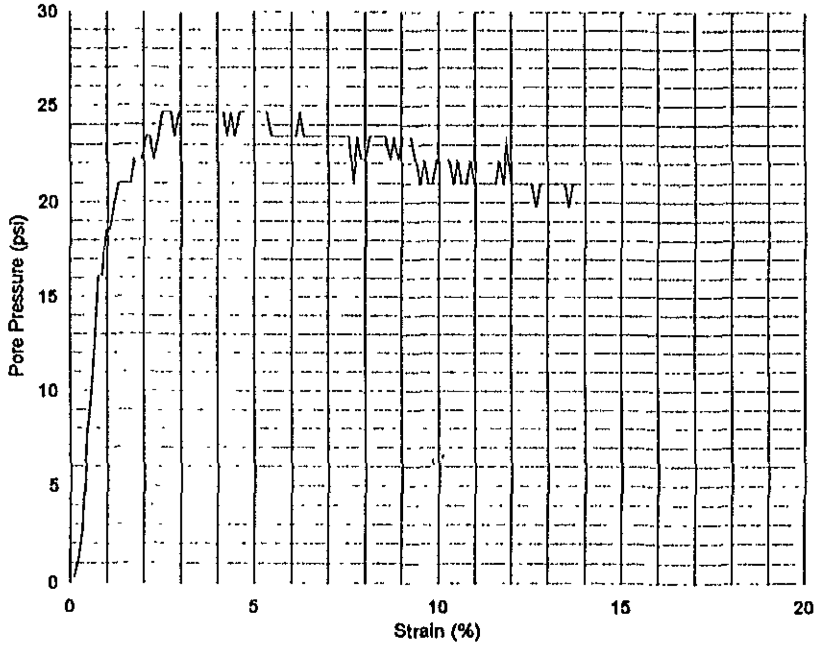
CONSOLIDATED ~~UNCONFINED~~ COMPRESSION TEST
UNDRAINED

STRESS V/S STRAIN



5.45 ksf

PORE PRESSURE V/S STRAIN

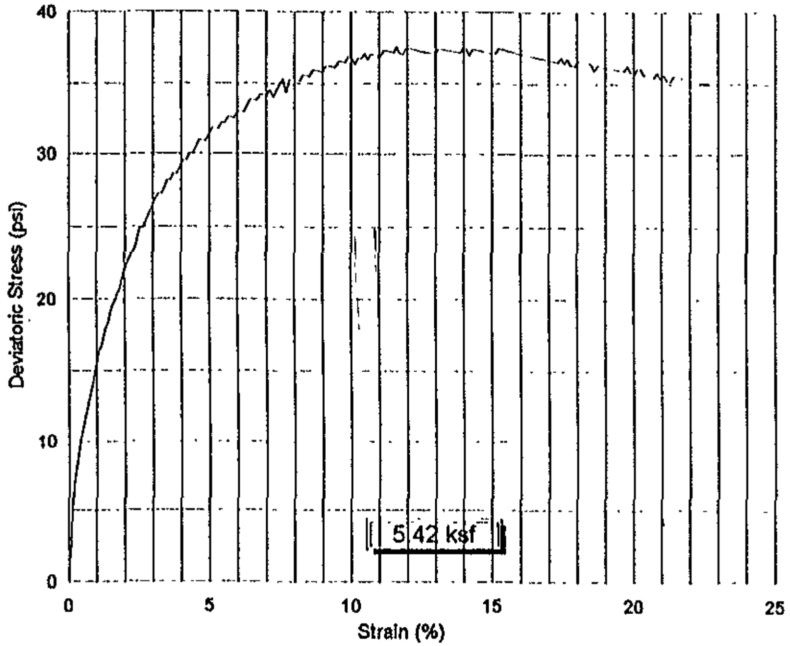


Height of Sample (inch)	5	Cell Pressure (psi)	35
Initial Diameter (inch)	2.416	Back Pressure (psi)	40
% Moisture - Before Test	28.5	Maximum Strength (psi))	37.83
% Moisture - After Test	- -	Strain @ Failure (%)	7.67
Dry Density (pcf)	94.2	Pore Pressure @Failure (psi)	23.44
sigma3' (psi)=	11.56	sigma1' (psi)=	49.39

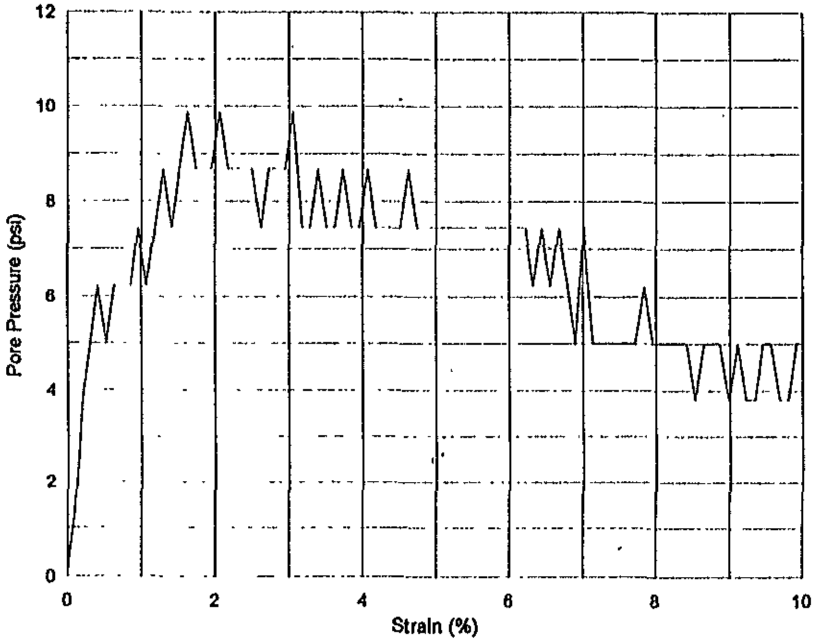
Boring No. B5 **Sample No.** 8A **Elev. or Depth (ft)** 35.5

Job Name : Permanente Creek Study **Job No.:** 999106.10 **PLATE NO.:** B-4F

CONSOLIDATED ~~UNCONFINED~~ UNDRAINED COMPRESSION TEST



STRESS V/S STRAIN



PORE PRESSURE V/S STRAIN

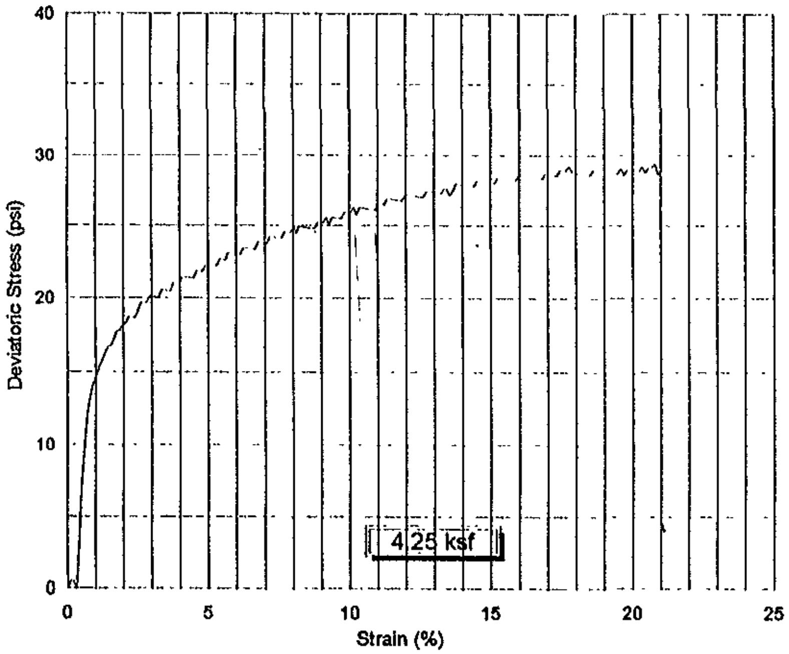
Height of Sample (inch)	5	Cell Pressure (psi)	10
Initial Diameter (inch)	2.416	Back Pressure (psi)	45
% Moisture - Before Test	21.2	Maximum Strength (psi))	37.63
% Moisture - After Test	20.4	Strain @ Failure (%)	11.61
Dry Density (pcf)	107.3	Pore Pressure @Failure (psi)	3.8
sigma3' (psi)=	6.2	sigma1' (psi)=	43.83

Boring No. B7 **Sample No.** 5B **Elev. or Depth (ft)** 21

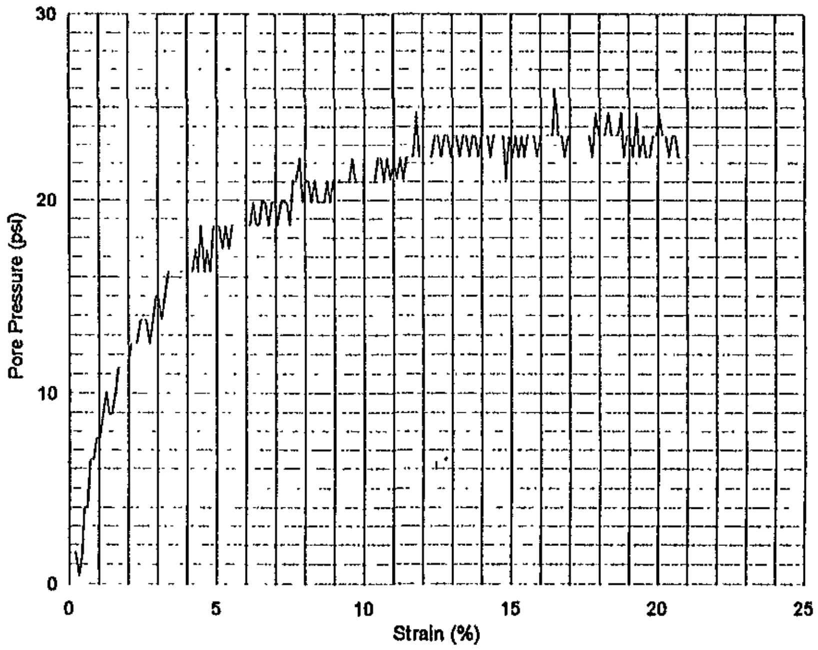
Job Name : Permanente Creek Study **Job No.:** 99106.10 **PLATE NO.:** B-4G

CONSOLIDATED ~~UNCONFINED~~ COMPRESSION TEST
UNDRAINED

STRESS V/S STRAIN



PORE PRESSURE V/S STRAIN



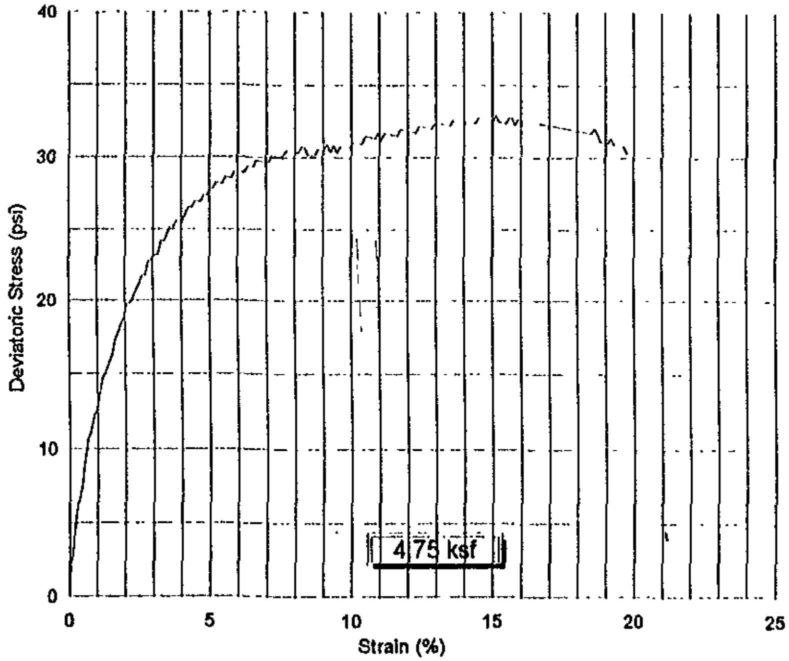
Height of Sample (inch)	5	Cell Pressure (psi)	30
Initial Diameter (inch)	2.416	Back Pressure (psi)	35
% Moisture - Before Test	24.8	Maximum Strength (psi))	29.50
% Moisture - After Test	23.2	Strain @ Failure (%)	20.79
Dry Density (pcf)	100.5	Pore Pressure @Failure (psi)	22.34

sigma3' (psi)= 7.66 sigma1' (psi)= 37.16

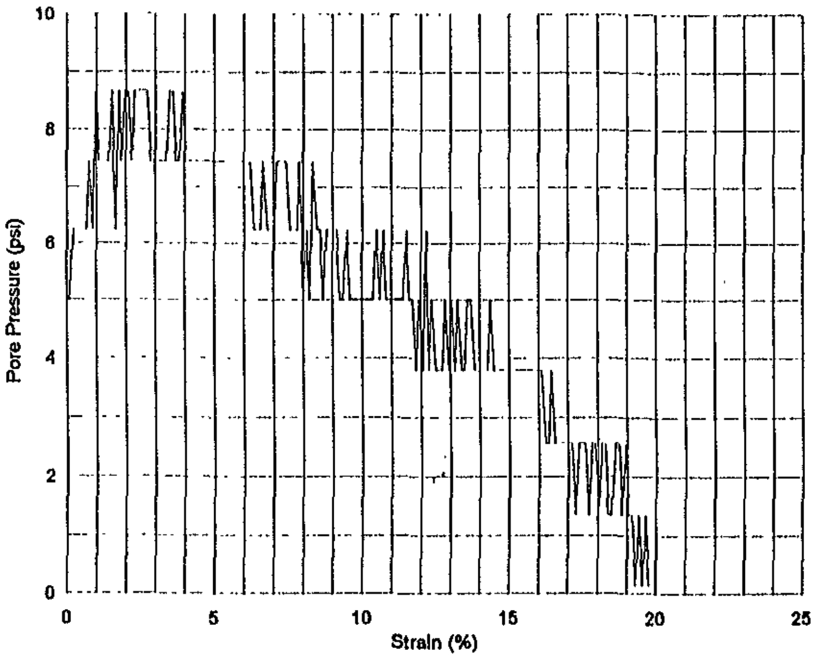
Boring No.	B9	**Sample No.**	7A	**Elev. or Depth (ft)**	32.5
Job Name :	Permanente Creek Study	**Job No.:**	999106.10	**PLATE NO.:**	B-4H

CONSOLIDATED ~~UNCONFINED~~ COMPRESSION TEST
UNDRAINED

STRESS V/S STRAIN



PORE PRESSURE V/S STRAIN



Height of Sample (inch)	5	Cell Pressure (psi)	10
Initial Diameter (inch)	2.416	Back Pressure (psi)	45
% Moisture - Before Test	11.4	Maximum Strength (psi))	32.96
% Moisture - After Test	14.8	Strain @ Failure (%)	15.14
Dry Density (pcf)	122.7	Pore Pressure @Failure (psi)	3.8
sigma3' (psi)=	6.2	sigma1' (psi)=	39.16

Boring No. B10 **Sample No.** 1B **Elev. or Depth (ft)** 2

Job Name : Permanente Creek Study **Job No.:** 999106.10 **PLATE NO.:** B-4I

Consolidated- Undrained

Triaxial Test Results for Sandy Lean & Lean Clays

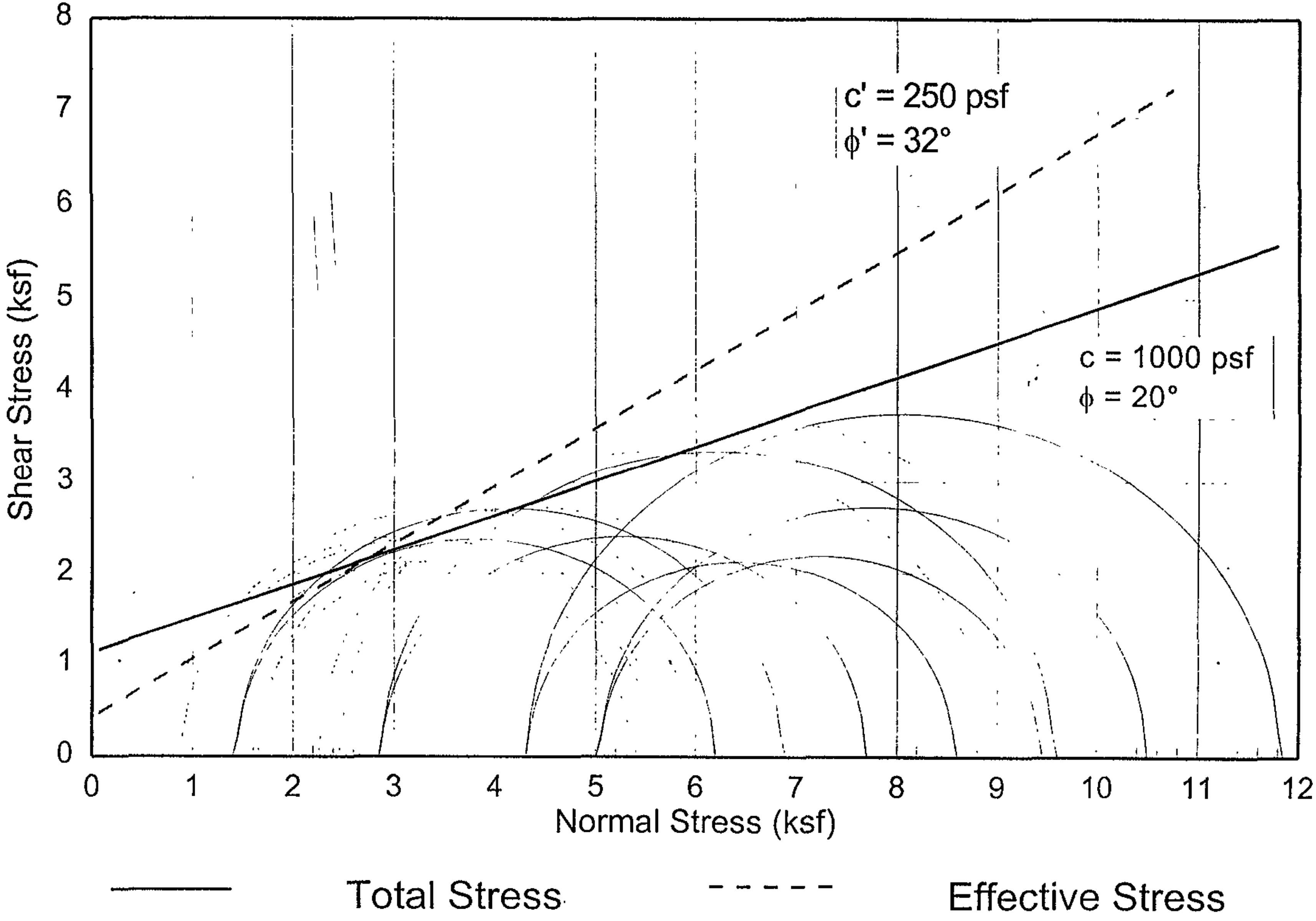
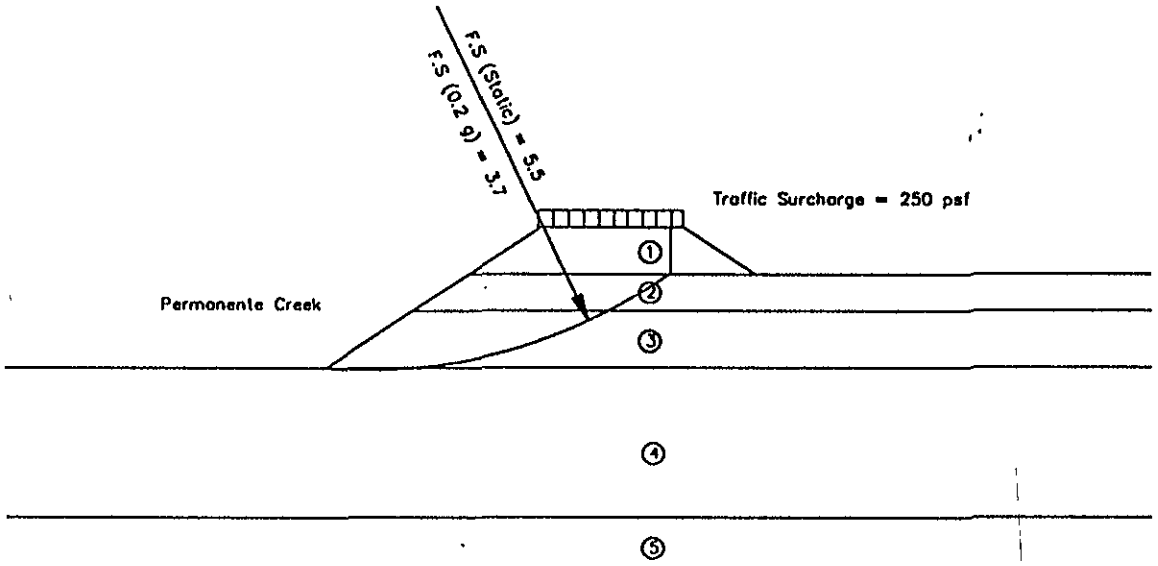


Plate B-4J

APPENDIX C

Soil No.	Soil Description	Moist Unit Weight (pcf)	Total Unit Weight (pcf)	Strength Parameters (Q or S)	
				c (psf)	Friction Angle
1	Sandy Fat Clay (CH)	120	125	2000	0
2	Lean Clay (CL)	120	125	2000	0
3	Silty Sand (SM)	120	125	0	35
4	Lean Clay w/ Sand (CL)	125	125	2500	0
5	Poorly graded Sand (SP)	125	125	0	38



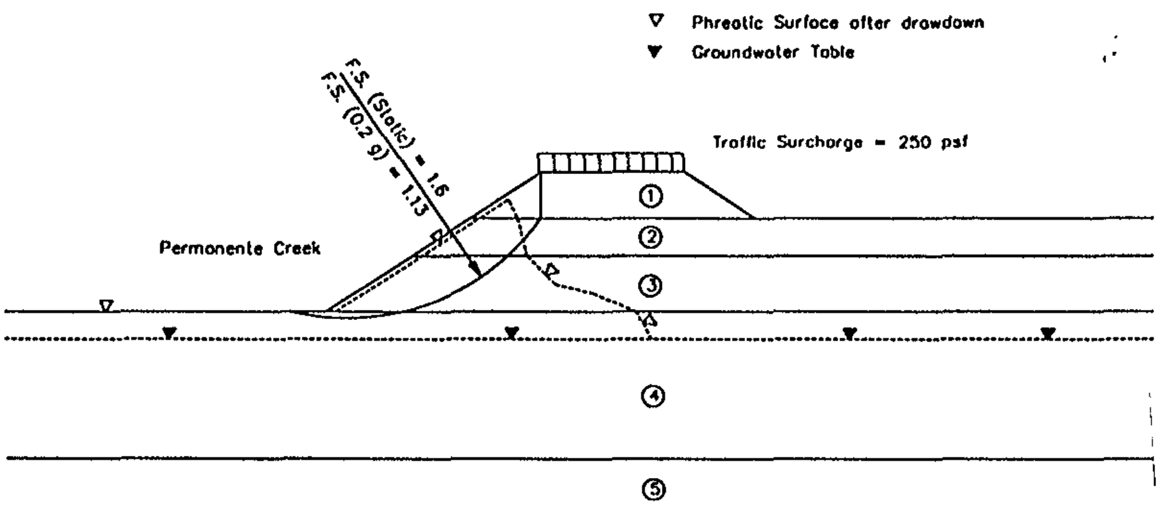
Scale: 1" = 20'

SLOPE STABILITY ANALYSIS – STA. 38+70 TO STA. 32+00

TOTAL STRESS ANALYSIS UNDER EXISTING CONDITIONS

PARIKH CONSULTANTS, INC. GEOTECHNICAL CONSULTANTS MATERIALS ENGINEERING	PERMANENTE CREEK LEVEES CERTIFICATION PROJECT CITY OF MOUNTAIN VIEW, CA
JOB NO.: 99106.10	PLATE NO.: C-1

Soil No.	Soil Description	Moist Unit Weight (pcf)	Total Unit Weight (pcf)	Shear Strength Parameters			
				Strength Parameters (S)		Strength Parameters (R)	
				c (psf)	Friction Angle	c (psf)	Friction Angle
1	Sandy Fat Clay (CH)	120	125	250	28	750	20
2	Lean Clay (CL)	120	125	250	32	1000	20
3	Silty Sand (SM)	120	125	0	35	0	35
4	Lean Clay w/ Sand (CL)	125	125	250	32	1000	20
5	Poorly graded Sand (SP)	125	125	0	38	0	38



Scale: 1" = 20'

SLOPE STABILITY ANALYSIS – STA. 38+70 TO STA. 32+00

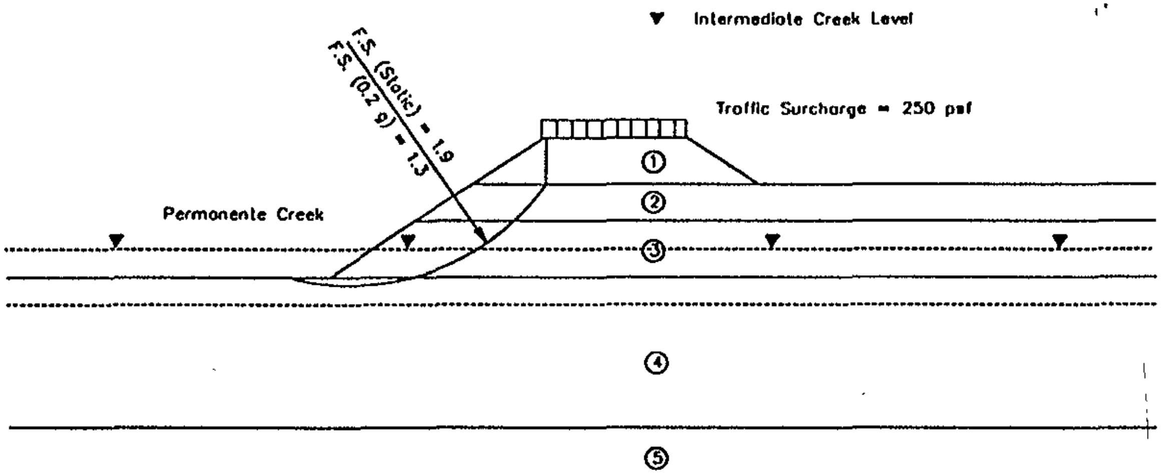
CASE 2 – RAPID DRAWDOWN ANALYSIS

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10	PLATE NO.: C-2

Soil No.	Soil Description	Moist Unit Weight (pcf)	Total Unit Weight (pcf)	Shear Strength Parameters			
				Strength Parameters (S)		Strength Parameters (R+S/2)	
				c (psf)	Friction Angle	c (psf)	Friction Angle
1	Sandy Fat Clay (CH)	120	125	250	28	500	24
2	Lean Clay (CL)	120	125	250	32	650	26
3	Silty Sand (SM)	120	125	0	35	0	35
4	Lean Clay w/ Sand (CL)	125	125	250	32	650	24
5	Poorly graded Sand (SP)	125	125	0	38	0	38



Scale: 1" = 20'

SLOPE STABILITY ANALYSIS – STA. 38+70 TO STA. 32+00

CASE 3 – INTERMEDIATE CREEK LEVEL ANALYSIS

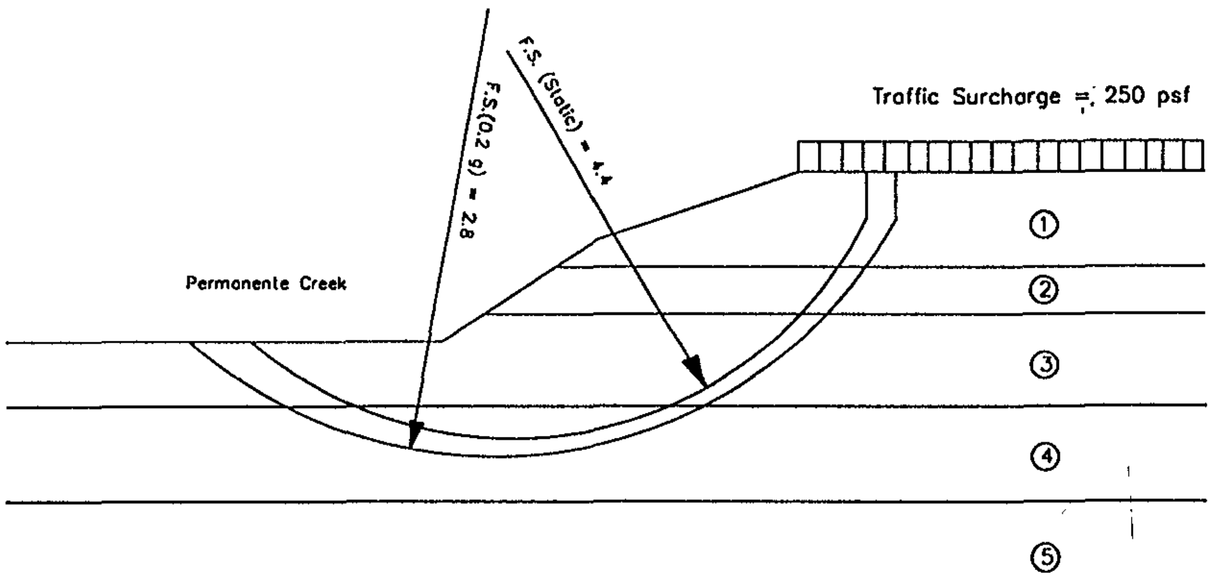
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10

PLATE NO.: C-3

Soil No.	Soil Description	Moist Unit Weight (pcf)	Total Unit Weight (pcf)	Strength Parameters (O or S)	
				c (psf)	Friction Angle
1	Sandy Lean Clay (CL)	120	125	2500	0
2	Fat Clay (CH)	120	125	2500	0
3	Lean Clay (CL)	120	125	1500	0
4	Silty Sand (SM)	125	125	0	38
5	Lean Clay w/ sand (CL)	125	125	2500	0



Scale: 1" = 20'

SLOPE STABILITY ANALYSIS – STA. 32+00 TO STA. 26+50

TOTAL STRESS ANALYSIS UNDER EXISTING CONDITIONS

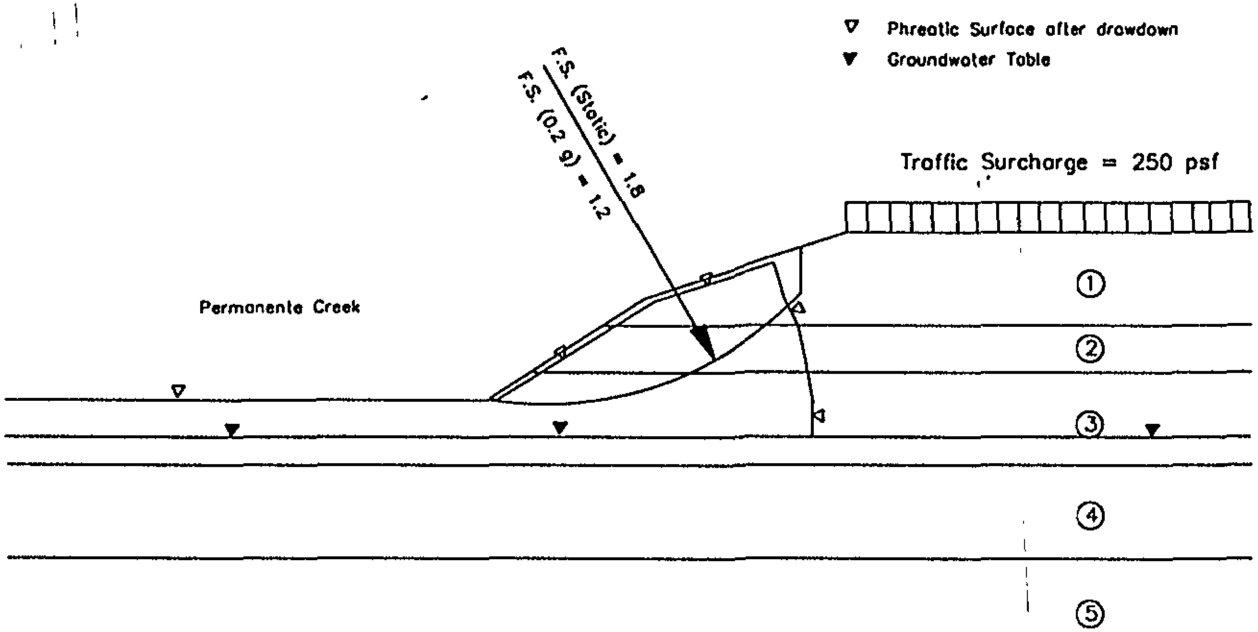
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10

PLATE NO.: C-4

Soil No.	Soil Description	Moist Unit Weight (pcf)	Total Unit Weight (pcf)	Shear Strength Parameters			
				Strength Parameters (S)		Strength Parameters (R)	
				c (psf)	Friction Angle	c (psf)	Friction Angle
1	Sandy Lean Clay (CL)	120	125	250	32	1000	20
2	Fat Clay (CH)	120	125	250	28	750	20
3	Lean Clay (CL)	120	125	250	32	1000	20
4	Silty Sand (SM)	125	125	0	38	0	38
5	Lean Clay w/ sand (CL)	125	125	250	32	1000	20



Scale: 1" = 20'

SLOPE STABILITY ANALYSIS – STA. 32+00 TO STA. 26+50

CASE 2 – RAPID DRAWDOWN ANALYSIS

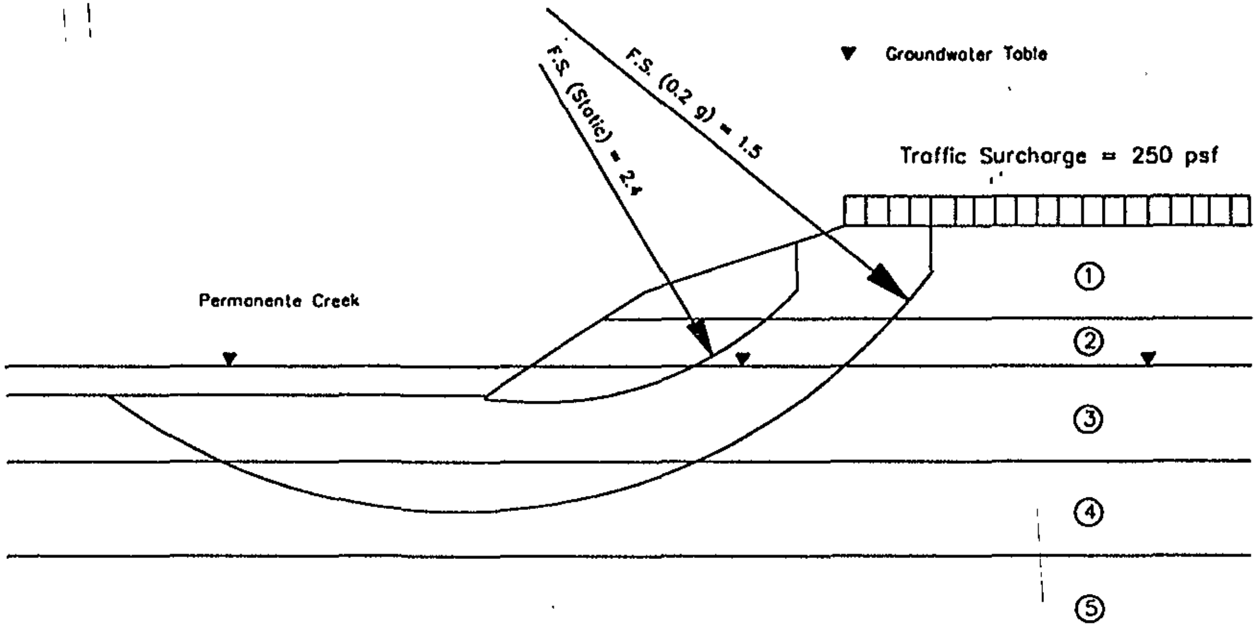
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10

PLATE NO.: C-5

Soil No.	Soil Description	Moist Unit Weight (pcf)	Total Unit Weight (pcf)	Shear Strength Parameters			
				Strength Parameters (S)		Strength Parameters (R+S/2)	
				c (psf)	Friction Angle	c (psf)	Friction Angle
1	Sandy Lean Clay (CL)	120	125	250	32	650	26
2	Fat Clay (CH)	120	125	250	28	500	24
3	Lean Clay (CL)	120	125	250	32	650	26
4	Silty Sand (SM)	125	125	0	38	0	38
5	Lean Clay w/ sand (CL)	125	125	250	32	650	26



Scale: 1" = 20'

SLOPE STABILITY ANALYSIS – STA. 32+00 TO STA. 26+50

CASE 3 – INTERMEDIATE CREEK LEVEL ANALYSIS

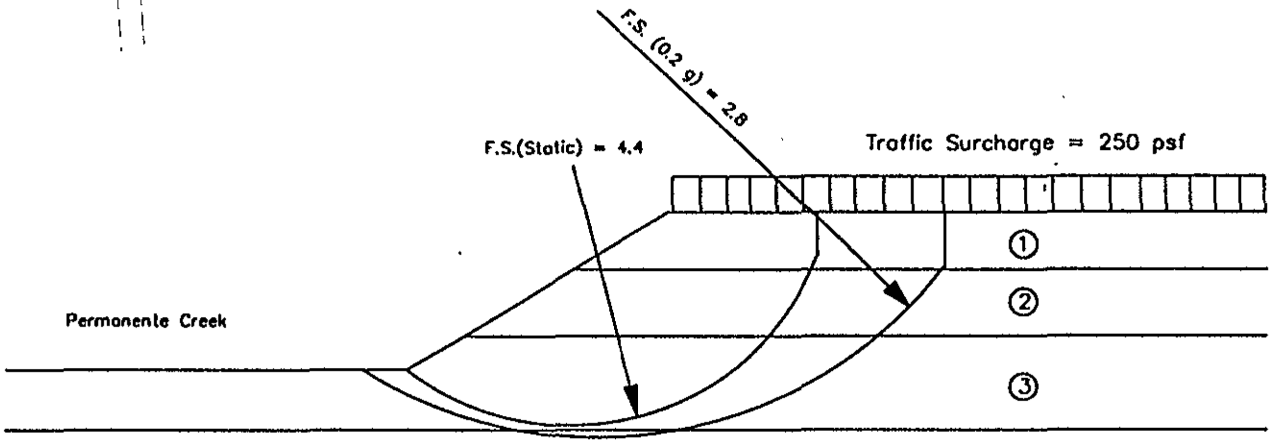
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10

PLATE NO.: C-6

Soil No.	Soil Description	Moist Unit Weight (pcf)	Total Unit Weight (pcf)	Strength Parameters (Q or S)	
				c (psf)	Friction Angle
1	Sandy Lean Clay (CL)	120	125	2500	0
2	Fat Clay (CH)	120	125	2500	0
3	Fat Clay (CH)	120	120	1500	0
4	Lean Clay (CL)	125	125	3000	0



Scale: 1" = 20'

SLOPE STABILITY ANALYSIS – STA. 23+00 TO STA. 26+50

TOTAL STRESS ANALYSIS UNDER EXISTING CONDITIONS

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

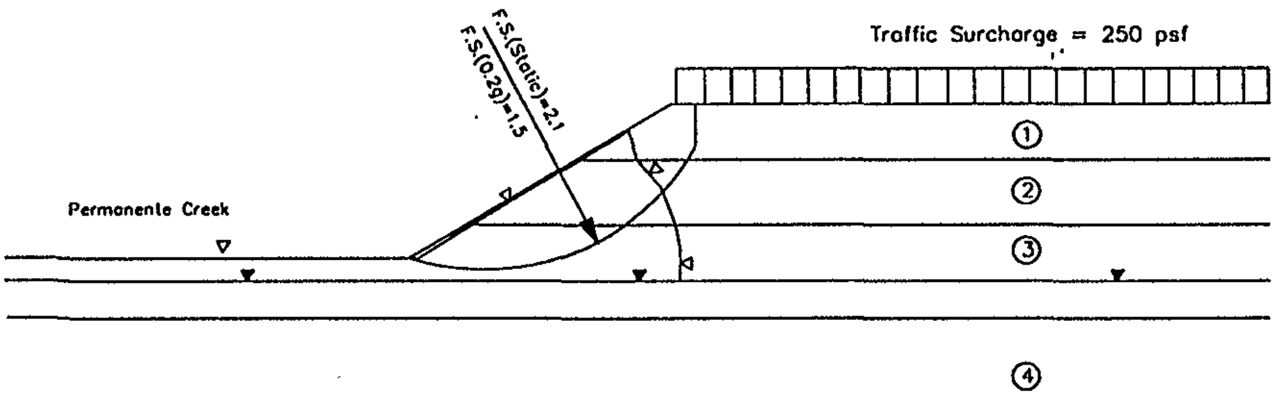
PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10

PLATE NO.: C-7

Soil No.	Soil Description	Moist Unit Weight (pcf)	Total Unit Weight (pcf)	Shear Strength Parameters			
				Strength Parameters (S)		Strength Parameters (R)	
				c (psf)	Friction Angle	c (psf)	Friction Angle
1	Sandy Lean Clay (CL)	120	125	250	32	1000	20
2	Fat Clay (CH)	120	125	250	28	750	20
3	Fat Clay (CH)	120	120	250	28	750	20
4	Lean Clay (CL)	125	125	250	32	1000	20

▽ Phreatic Surface after drawdown
▼ Groundwater Table



Scale: 1" = 20'

SLOPE STABILITY ANALYSIS – STA. 23+00 TO STA. 26+50
CASE 2 – RAPID DRAWDOWN ANALYSIS

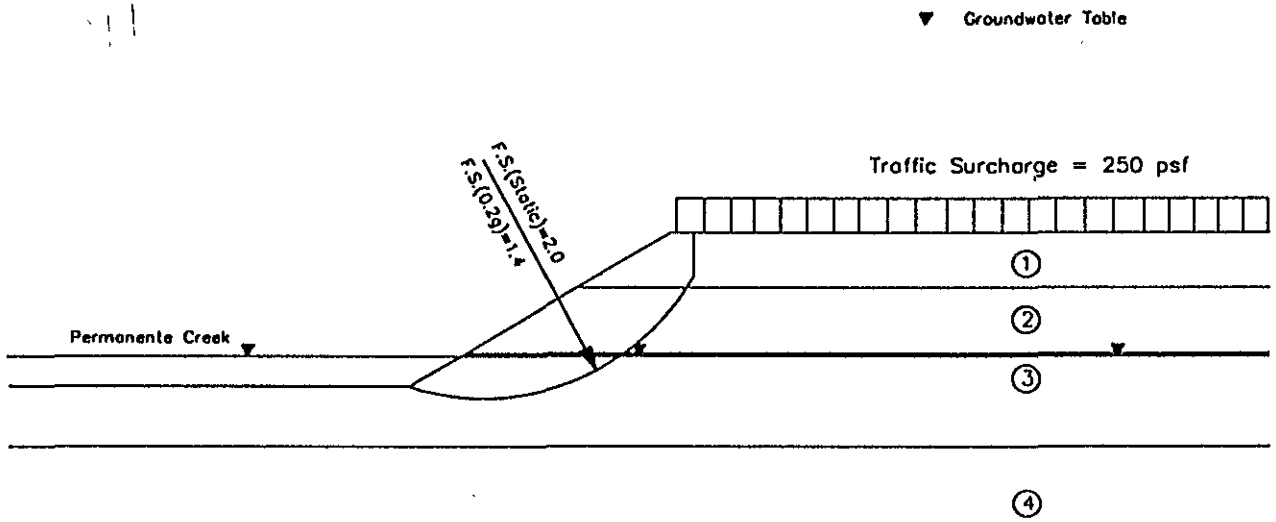
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10

PLATE NO.: C-8

Soil No.	Soil Description	Moist Unit Weight (pcf)	Total Unit Weight (pcf)	Shear Strength Parameters			
				Strength Parameters (S)		Strength Parameters (R+s/2)	
				c (psf)	Friction Angle	c (psf)	Friction Angle
1	Sandy Lean Clay (CL)	120	125	250	32	650	26
2	Fat Clay (CH)	120	125	250	28	500	24
3	Fat Clay (CH)	120	120	250	28	500	24
4	Lean Clay (CL)	125	125	250	32	650	26



Scale: 1" = 20'

SLOPE STABILITY ANALYSIS – STA. 23+00 TO STA. 26+50

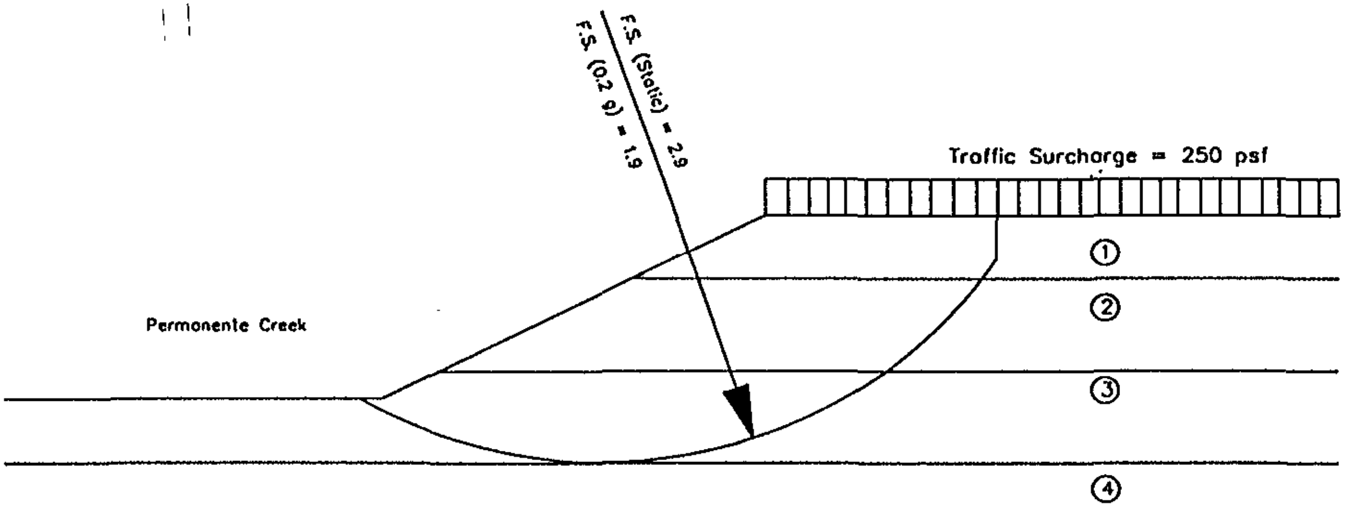
CASE 3 – INTERMEDIATE CREEK LEVEL ANALYSIS

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10	PLATE NO.: C-9

Soil No.	Soil Description	Moist Unit Weight (pcf)	Total Unit Weight (pcf)	Strength Parameters (Q or S)	
				c (psf)	Friction Angle
1	Sandy Lean Clay (CL)	120	125	2500	0
2	Fat Clay (CH)	120	125	2500	0
3	Bay Mud (OH)	95	95	900	0
4	Lean Clay (CL)	125	125	3000	0



Scale: 1" = 20'

SLOPE STABILITY ANALYSIS – STA. 19+50 TO STA. 23+00

TOTAL STRESS ANALYSIS UNDER EXISTING CONDITIONS

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

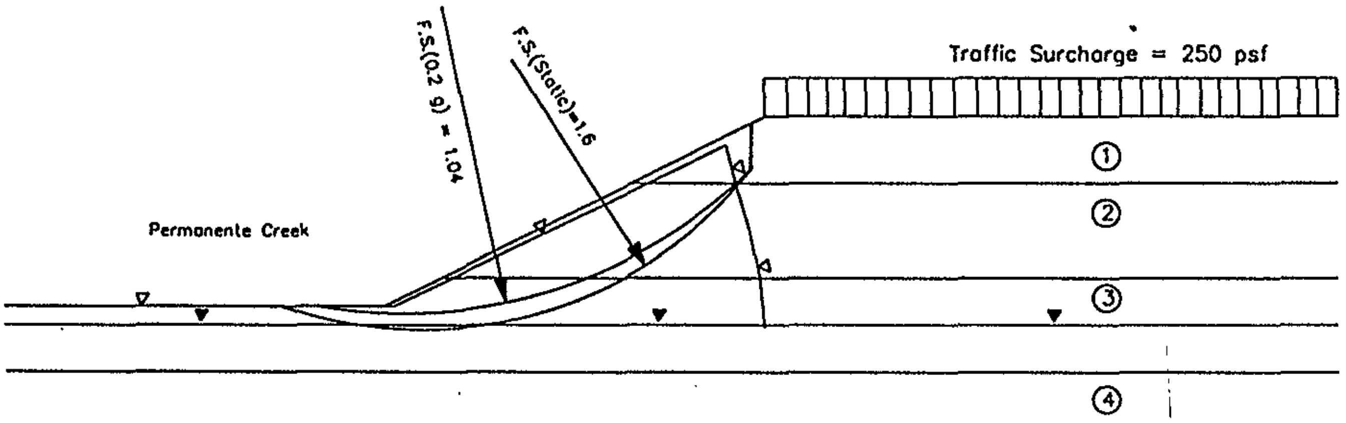
JOB NO.: 99106.10

PLATE NO.: C-10

Soil No.	Soil Description	Moist Unit Weight (pcf)	Total Unit Weight (pcf)	Shear Strength Parameters			
				Strength Parameters (S)		Strength Parameters (R)	
				c (psf)	Friction Angle	c (psf)	Friction Angle
1	Sandy Lean Clay (CL)	120	125	250	32	1000	20
2	Fat Clay (CH)	120	125	250	28	750	20
3	Bay Mud (OH)	95	95	100	26	250	20
4	Lean Clay (CL)	125	125	250	32	1000	20

▽ Phreatic Surface after drawdown

▼ Groundwater Table



Scale: 1" = 20'

SLOPE STABILITY ANALYSIS – STA. 19+50 TO STA. 23+00

CASE 2 – RAPID DRAWDOWN ANALYSIS

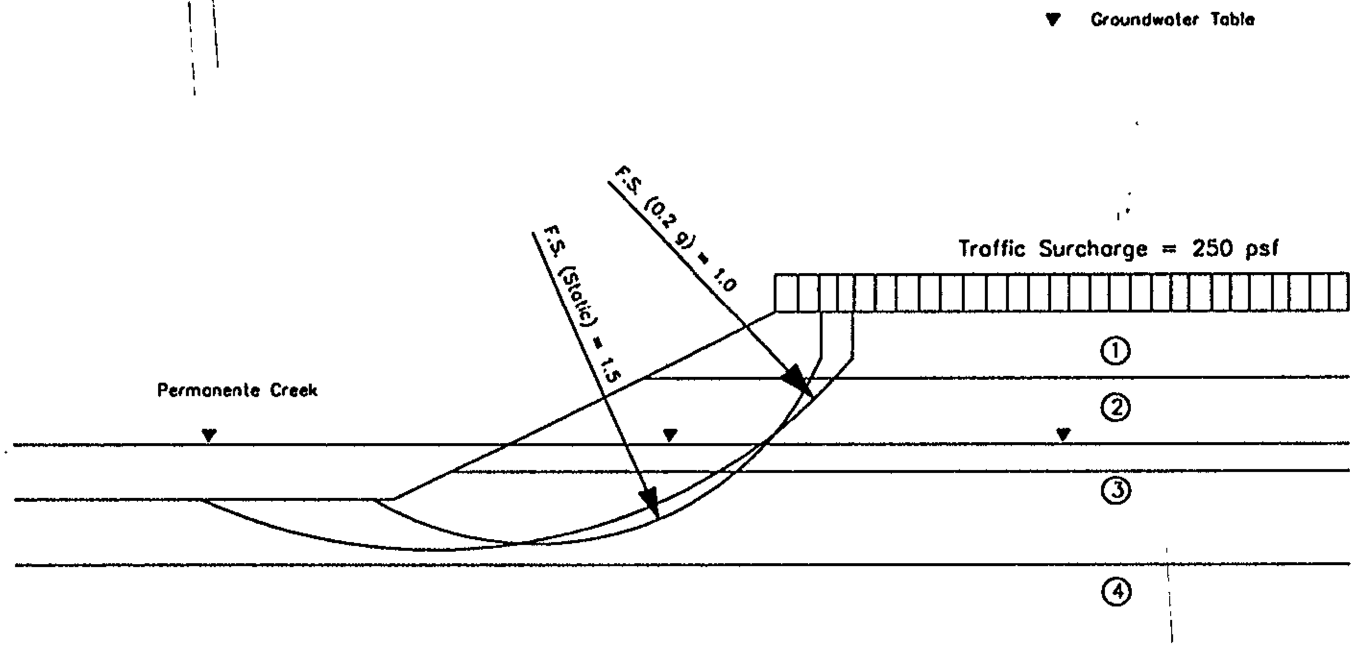
PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10

PLATE NO.: C-11

Soil No.	Soil Description	Moist Unit Weight (pcf)	Total Unit Weight (pcf)	Shear Strength Parameters			
				Strength Parameters (S)		Strength Parameters (R+S/2)	
				c (psf)	Friction Angle	c (psf)	Friction Angle
1	Sandy Lean Clay (CL)	120	125	250	32	650	26
2	Fat Clay (CH)	120	125	250	28	500	24
3	Bay Mud (OH)	95	95	100	26	175	23
4	Lean Clay (CL)	125	125	250	32	650	26



Scale: 1" = 20'

SLOPE STABILITY ANALYSIS – STA. 19+50 TO STA. 23+00

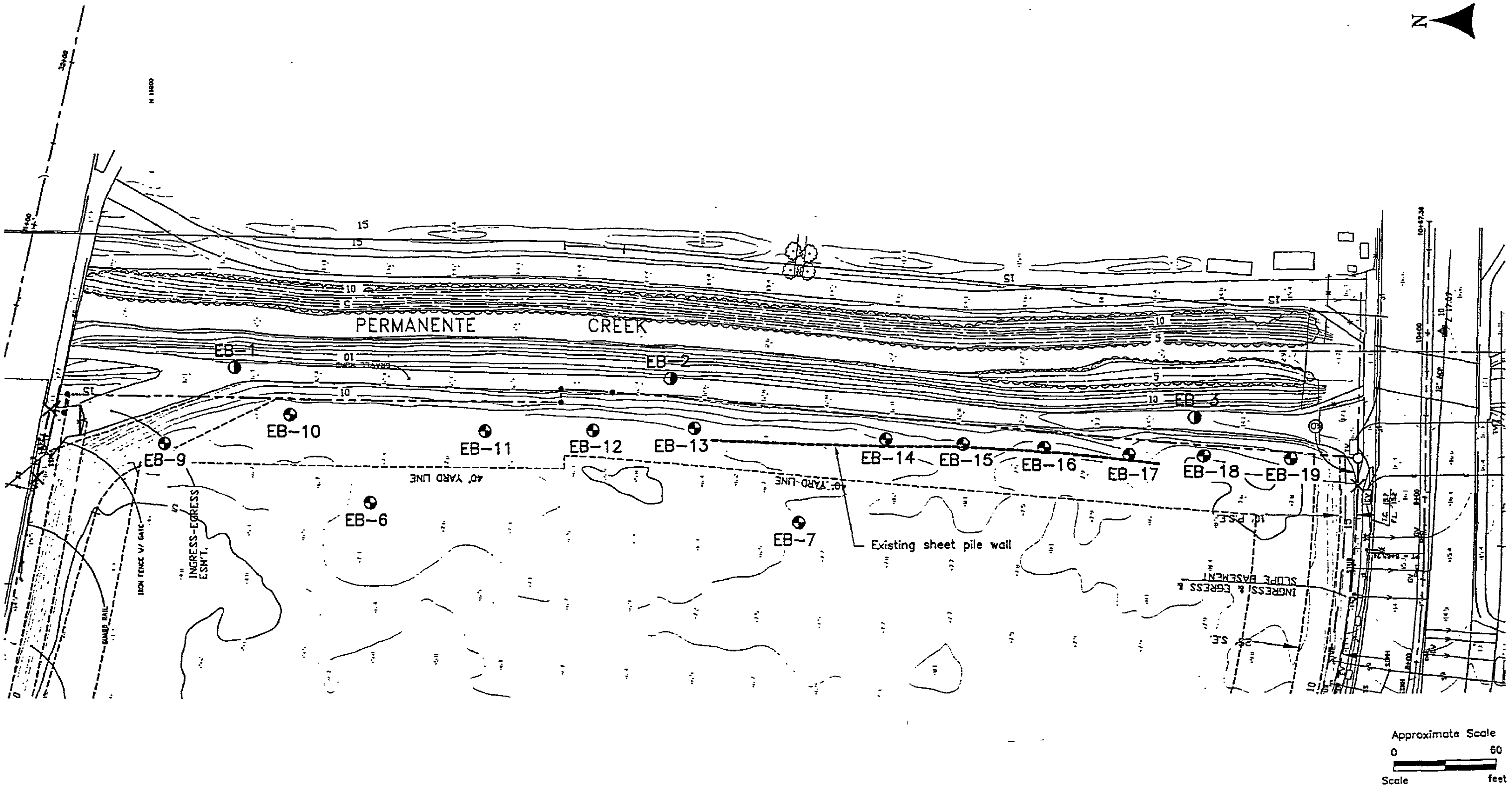
CASE 3 – INTERMEDIATE CREEK LEVEL ANALYSIS

PARIKH CONSULTANTS, INC.
GEOTECHNICAL CONSULTANTS
MATERIALS ENGINEERING

PERMANENTE CREEK LEVEES CERTIFICATION PROJECT
CITY OF MOUNTAIN VIEW, CA

JOB NO.: 99106.10	PLATE NO.: C-12

APPENDIX D



LEGEND

◑ – Approximate location of exploratory boring

⊕ – Approximate location of previous exploratory boring (5/97)

Base by Mark Thomas & Co.

SITE PLAN
ALZA CORPORATE OFFICES
Mountain View, California

LOWNEYASSOCIATES
Environmental/Geotechnical/Engineering Services

FIGURE 2

1026-3C

5/99-EB

APPENDIX A

FIELD INVESTIGATION

The field investigation consisted of a surface reconnaissance and a subsurface exploration program using track-mounted, rotary-wash drilling equipment. Three 4 7/8-inch-diameter exploratory borings were drilled on March 17, 1999, to a maximum depth of 30 feet. The approximate locations of the exploratory borings are shown on the Site Plan, Figure 2. The soils encountered were continuously logged in the field by our representative and described in accordance with the Unified Soil Classification System (ASTM D-2488). The logs of the borings, as well as a key to the classification of the soil, are included as part of this appendix.

The locations of borings were approximately determined by pacing from existing site boundaries. Elevations of the borings were determined by interpolation from plan contours. The locations and elevations of the borings should be considered accurate only to the degree implied by the method used.

Representative soil samples were obtained from the borings at selected depths. All samples were returned to our laboratory for evaluation and appropriate testing. The standard penetration resistance blow counts were obtained by dropping a 140-pound hammer through a 30-inch free fall. The 2-inch O.D. split spoon sampler was driven 18 inches and the number of blows was recorded for each 6 inches of penetration (ASTM D-1586). In addition, 2.5-inch I.D. samples were obtained using a Modified California Sampler driven into the soil with the 140-pound hammer previously described. Relatively undisturbed samples were also obtained with 3.0-inch I.D. Shelby Tube Samplers, which were hydraulically pushed. Unless otherwise indicated, the blows per foot recorded on the boring log represent the accumulated number of blows required to drive the last 12 inches. The various samplers are denoted at the appropriate depth on the boring logs and symbolized as shown on Figure A-1.

Field tests included an evaluation of the undrained shear strength of soil samples using a Torvane device, and the unconfined compressive strength of the soil samples using a pocket penetrometer device. The results of these tests are presented on the individual boring logs at the appropriate sample depth.

The attached boring logs and related information depict subsurface conditions only at the locations indicated and at the particular date designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at these boring locations. The passage of time may result in altered subsurface conditions due to environmental changes. In addition, any stratification lines on the logs represent the approximate boundary between soil types and the transition may be gradual.

* * * * * * * * *

PRIMARY DIVISIONS			SOIL TYPE		SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (Less than 5% Fines)	GW	●	Well graded gravels, gravel-sand mixtures, little or no fines
			GP	○	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GRAVEL WITH FINES	GM	○	Silty gravels, gravel-sand-silt mixtures, plastic fines
			GC	▨	Clayey gravels, gravel-sand-clay mixtures, plastic fines
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (Less than 5% Fines)	SW	⁘	Well graded sands, gravelly sands, little or no fines
			SP	⁘	Poorly graded sands or gravelly sands, little or no fines
		SANDS WITH FINES	SM	⁘	Silty sands, sand-silt-mixtures, non-plastic fines
			SC	▨	Clayey sands, sand-clay mixtures, plastic fines
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50 %		ML	▥	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	▨	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	▤	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50 %		MH	▥	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	▨	Inorganic clays of high plasticity, fat clays
			OH	≋	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			PT	⁂	Peat and other highly organic soils

DEFINITION OF TERMS

U.S. STANDARD SIEVE SIZE — CLEAR SQUARE SIEVE OPENINGS

200 — 40 — 10 — 4 — 3/4" — 3" — 12"

SILTS AND CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

GRAIN SIZES

☒ TERZAGHI SPLIT SPOON STANDARD PENETRATION

⧗ MODIFIED CALIFORNIA

▯ D & M UNDERWATER SAMPLER

■ SHELBY TUBE

○ NO RECOVERY

SAMPLERS

SAND AND GRAVEL	BLOWS/FOOT*
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

RELATIVE DENSITY

SILTS AND CLAYS	STRENGTH+	BLOWS/FOOT*
VERY SOFT	0-1/4	0-2
SOFT	1/4-1/2	2-4
MEDIUM STIFF	1/2-1	4-8
STIFF	1-2	8-16
VERY STIFF	2-4	16-32
HARD	OVER 4	OVER 32

CONSISTENCY

*Number of blows of 140 pound hammer falling 30 inches to drive a 2-inch O.D. (1-3/8 inch I.D.) split spoon (ASTM D-1586).
+Unconfined compressive strength in tons/sq.ft. as determined by laboratory testing or approximated by the standard penetration test (ASTM D-1586), pocket penetrometer, torvane, or visual observation.

KEY TO EXPLORATORY BORING LOGS

Unified Soil Classification System (ASTM D-2487)

LOWNEYASSOCIATES
Environmental/Geotechnical/Engineering Services

FIGURE A-1

EXPLORATORY BORING: EB-1

Sheet 1 of 1

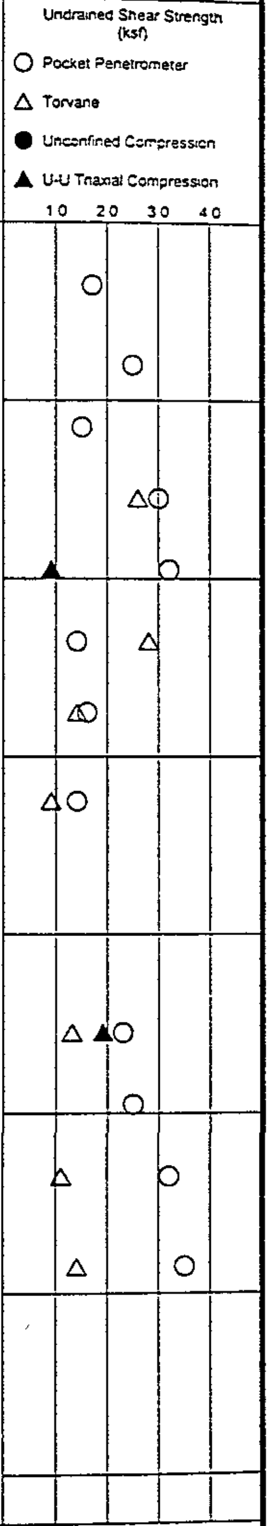
DRILL RIG: FAILING 250
BORING TYPE: ROTARY WASH
LOGGED BY: LCK
START DATE: 3-17-99 FINISH DATE: 3-17-99

PROJECT NO: 1026-3C
PROJECT: ALZA CORPORATE OFFICES
LOCATION: MOUNTAIN VIEW
COMPLETION DEPTH: 30.0 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

SURFACE ELEVATION: 12.1 FT. (+/-)

ELEVATION (FT)	DEPTH (FT)	SOIL LEGEND	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT)	SAMPLER	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO 200 SIEVE
12.1	0		SILTY CLAY (CL/CH) [FILL] stiff, moist, brown and black, moderate and high plasticity, trace sand and fine gravel						
					12		20	103	
					300psi		21	107	
	5			CL-CH					
					18		9		
					25		22	101	
			increasing gravel						
2.5	10		SANDY CLAY (CL) stiff, moist, light gray, moderate to high plasticity, trace sand		500psi		24	100	
			color grades to brown	CL	24		22	102	
					11		25	103	
-1.9			SILTY CLAY (CL) stiff, moist, light brown, moderate plasticity						
	15								
				CL	250psi		22	105	
-6.1			CLAYEY SAND (SC) medium dense, wet, brown, low to moderate plasticity, very fine to fine sand		150psi				
	20			SC					
					500psi				
-9.7			SILTY CLAY (CL) stiff, moist, brown, moderate plasticity color grades to greenish gray		20		30	96	
					42		27	103	
	25		very stiff, color grades to brown	CL					
					34		25	104	
			color grades to greenish gray		55		24	105	
-17.9	30		Bottom of Boring @ 30 feet.						
	35								



GROUND WATER OBSERVATIONS:
NOT APPLICABLE DUE TO ROTORY WASH METHOD OF DRILLING

LOWNEYASSOCIATES
Environmental/Geotechnical/Engineering Services

EXPLORATORY BORING: EB-2

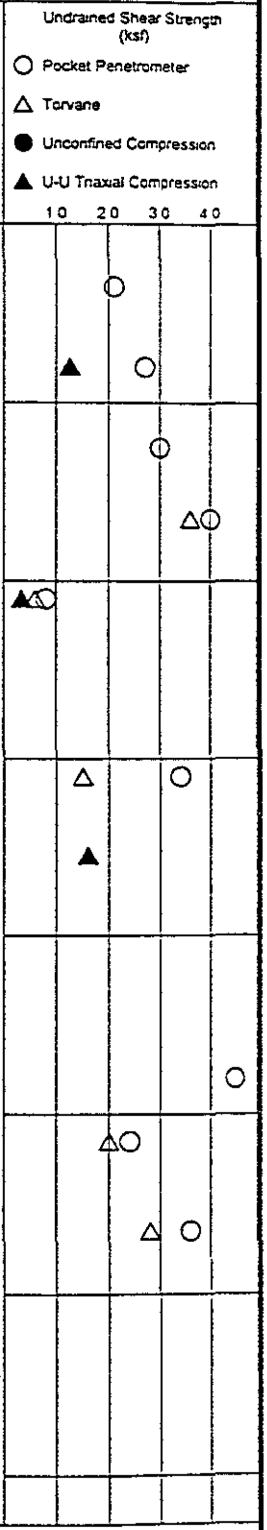
Sheet 1 of 1

DRILL RIG: FAILING 250	PROJECT NO: 1026-3C
BORING TYPE: ROTARY WASH	PROJECT: ALZA CORPORATE OFFICES
LOGGED BY: LCK	LOCATION: MOUNTAIN VIEW
START DATE: 3-17-99 FINISH DATE: 3-17-99	COMPLETION DEPTH: 29.0 FT.

This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

SURFACE ELEVATION: 12.3 FT. (+/-)

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO 200 SIEVE
12.3	0	SILTY CLAY (CL/CH) [FILL]					
		stiff, moist, brown and black, moderate and high plasticity, trace sand, fine gravel		16	22	91	
				400psi	21	87	
	5	Average vertical permeability = 2x10E-5 cm/s	CL-CH				
		very stiff		400psi	25	92	
		Average vertical permeability = 2x10E-6 cm/s					
		color grades to black, high plasticity		25	25	100	
		trace wood					
2.1	10	SANDY CLAY (CL) medium stiff, moist, brown, moderate plasticity		350psi	28	92	
		wet		400psi			
			CL				
	15			400psi			
				400psi	24	102	
-6.7		SAND (SP-SC)					
	20	dense, brown, fine to medium sand, trace clay	SP-SC	40	12		
		increasing fine gravel					
-9.9		SILTY CLAY (CL) hard, moist, greenish gray		7	10		
				400psi			
	25	very stiff					
			CL	35	25	104	
		color grades to olive brown					
				54	25	103	
-16.7							
	30	Bottom of Boring @ 29 feet.					
	35						



GROUND WATER OBSERVATIONS:

NOT APPLICABLE DUE TO ROTORY WASH METHOD OF DRILLING

LOWNEYASSOCIATES
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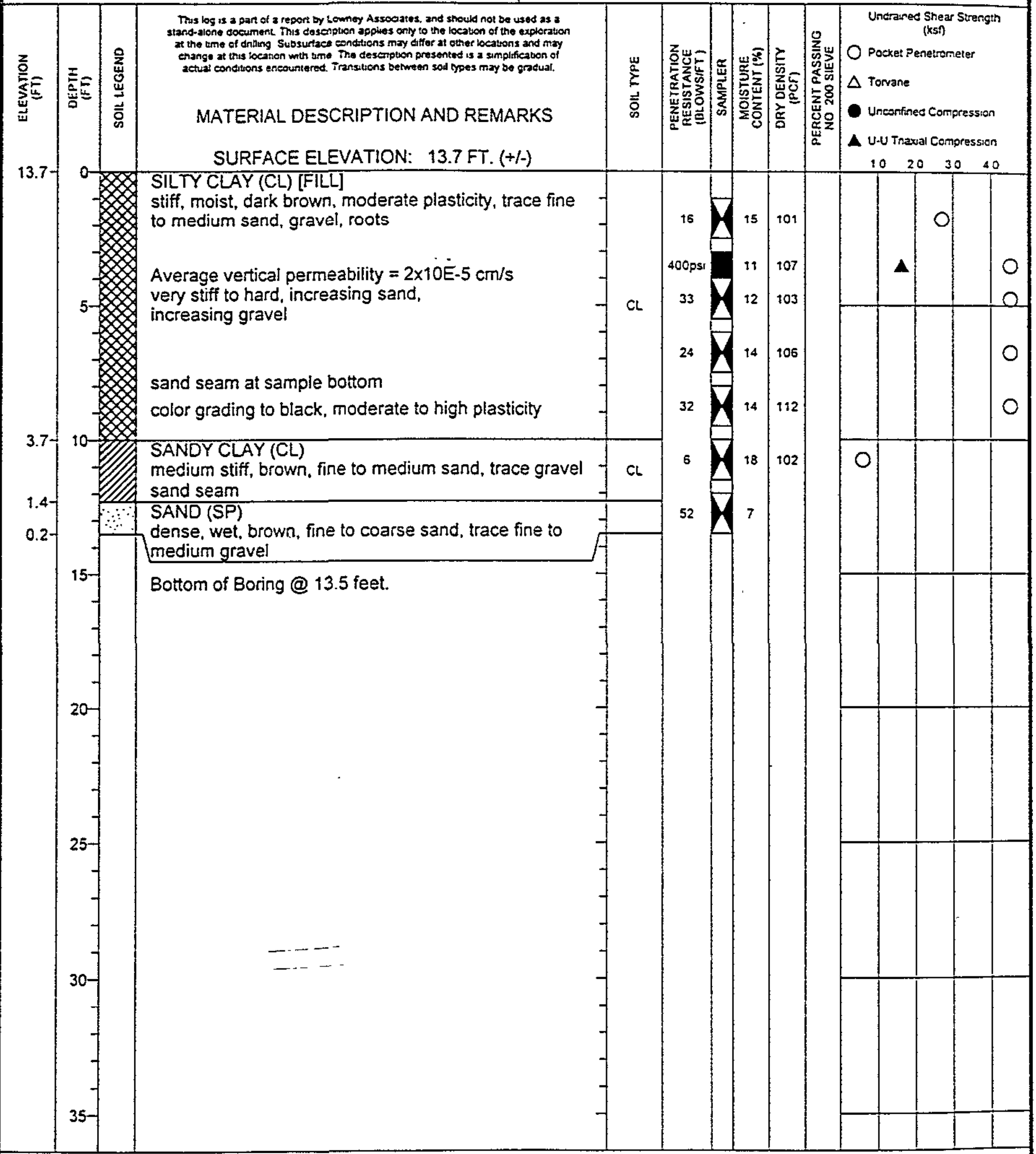
EXPLORATORY BORING: EB-3

Sheet 1 of 1

DRILL RIG: FAILING 250
BORING TYPE: ROTARY WASH
LOGGED BY: LCK
START DATE: 3-17-99 FINISH DATE: 3-17-99

PROJECT NO: 1026-3C
PROJECT: ALZA CORPORATE OFFICES
LOCATION: MOUNTAIN VIEW
COMPLETION DEPTH: 13.5 FT.



This log is a part of a report by Lowney Associates, and should not be used as a stand-alone document. This description applies only to the location of the exploration at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with time. The description presented is a simplification of actual conditions encountered. Transitions between soil types may be gradual.

SURFACE ELEVATION: 13.7 FT. (+/-)

ELEVATION (FT)	DEPTH (FT)	MATERIAL DESCRIPTION AND REMARKS	SOIL TYPE	PENETRATION RESISTANCE (BLOWS/FT)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	PERCENT PASSING NO. 200 SIEVE
13.7	0	SILTY CLAY (CL) [FILL] stiff, moist, dark brown, moderate plasticity, trace fine to medium sand, gravel, roots		16	15	101	
		Average vertical permeability = 2x10E-5 cm/s		400psi	11	107	
	5	very stiff to hard, increasing sand, increasing gravel	CL	33	12	103	
				24	14	106	
		sand seam at sample bottom color grading to black, moderate to high plasticity		32	14	112	
3.7	10	SANDY CLAY (CL) medium stiff, brown, fine to medium sand, trace gravel sand seam	CL	6	18	102	
1.4		SAND (SP) dense, wet, brown, fine to coarse sand, trace fine to medium gravel		52	7		
0.2							
	15	Bottom of Boring @ 13.5 feet.					

GROUND WATER OBSERVATIONS:
NOT APPLICABLE DUE TO ROTORY WASH METHOD OF DRILLING

CORP.GDT 5/11/99 MV*.DGB

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APPENDIX B

LABORATORY INVESTIGATION

The laboratory testing program was directed toward a quantitative and qualitative evaluation of the physical and mechanical properties of the soils underlying the site and to aid in verifying soil classification.

Moisture Content: The natural water content was determined (ASTM D-2216) on 29 samples of the materials recovered from the borings. These water contents are recorded on the boring logs at the appropriate sample depths.

Dry Densities: In place dry density determinations (ASTM D-2937) were performed on 25 samples to measure the unit weight of the subsurface soils. Results of these tests are shown on the boring logs at the appropriate sample depths.

UU-Triaxial Compression: Unconsolidated-undrained triaxial compression tests (ASTM D2850) were performed on seven undisturbed samples of the clayey subsurface soils to evaluate the undrained shear strengths of these materials. Failure was taken as the peak normal stress. Results of these tests are presented on the boring logs at the appropriate sample depths.

CU-Triaxial Compression: Consolidated-undrained triaxial compression tests with pore pressure measurements (ASTM D4767) were performed on three undisturbed samples of the clayey fill soils and three undisturbed samples of the native clayey soils to evaluate the undrained shear strengths of these materials. Failure was taken as the peak normal stress. Results of these tests are presented on the boring logs at the appropriate sample depths.

Permeability: Constant head permeability tests (ASTM D5084) were performed on three undisturbed samples of the existing clayey fill soils to estimate the coefficient of permeability. Results of these tests are presented on the boring logs at the appropriate sample depths .

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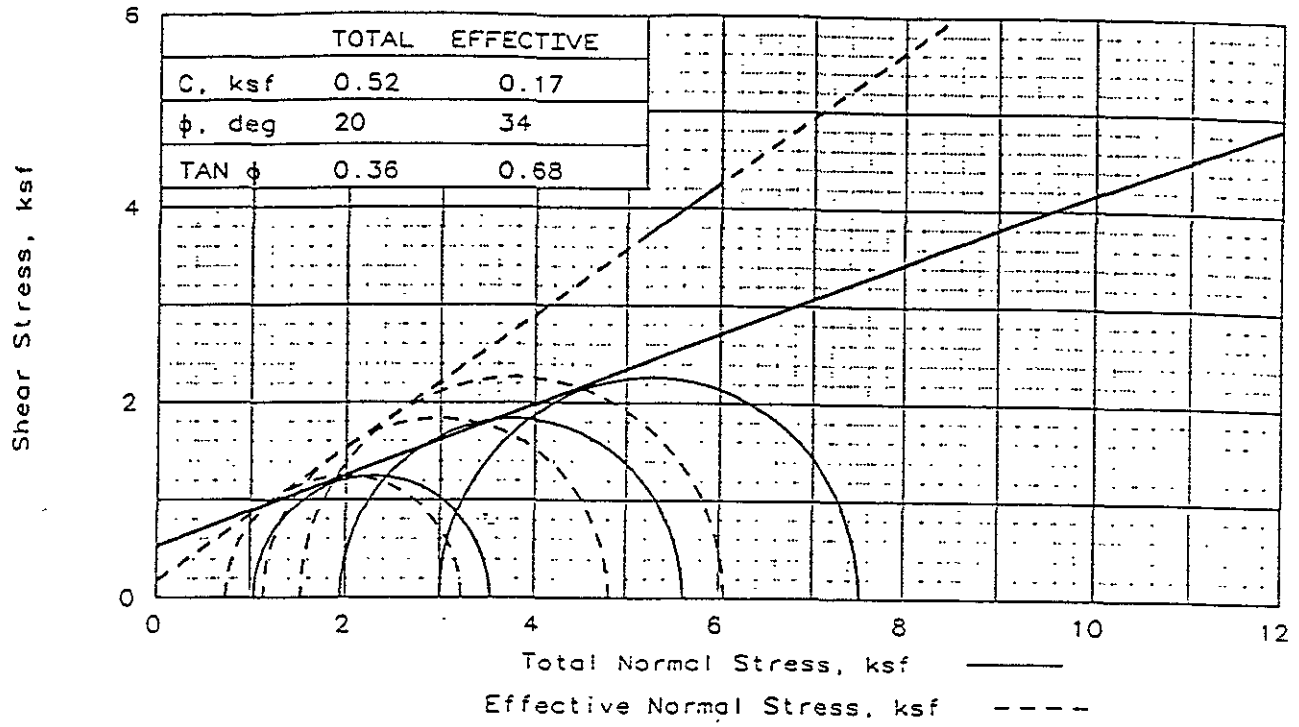
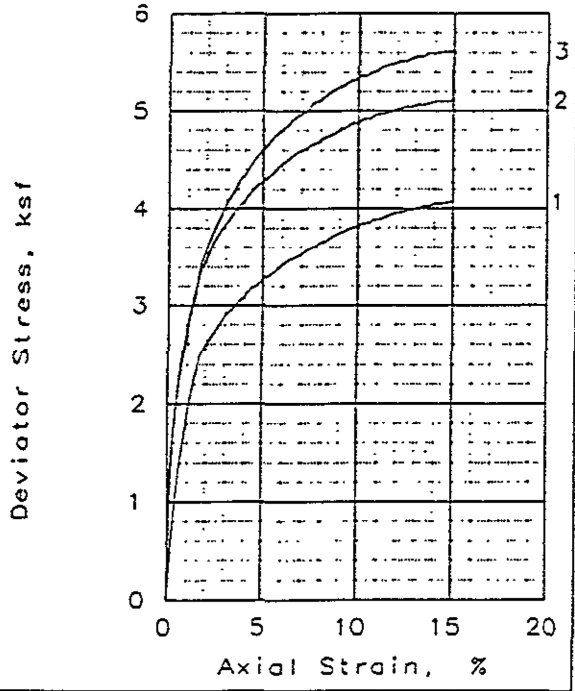


	TOTAL	EFFECTIVE
C, ksf	0.52	0.17
ϕ, deg	20	34
TAN ϕ	0.36	0.68



SAMPLE NO.:		1	2	3
INITIAL	WATER CONTENT, %	21.8	22.9	22.7
	DRY DENSITY, pcf	106.9	104.1	105.0
	SATURATION, %	96.1	94.2	95.7
	VOID RATIO	0.635	0.679	0.664
	DIAMETER, in	2.87	2.87	2.87
	HEIGHT, in	6.00	6.00	6.00
AT TEST	WATER CONTENT, %	22.0	22.8	21.7
	DRY DENSITY, pcf	108.2	106.7	108.7
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.615	0.638	0.609
	DIAMETER, in	2.86	2.84	2.83
	HEIGHT, in	5.98	5.96	5.95
Strain rate, %/min		0.03		0.03
EFF CELL PRESSURE, ksf		1.04	1.94	3.00
Deviator Stress, ksf		2.49	3.67	4.53
EXCESS PORE PR., ksf		0.30	0.81	1.47
STRAIN, %		1.7	2.4	4.6
ULT. STRESS, ksf				
EXCESS PORE PR., ksf				
STRAIN, %				
$\bar{\sigma}_1$ FAILURE, ksf		3.23	4.81	6.05
$\bar{\sigma}_3$ FAILURE, ksf		0.73	1.14	1.53

TYPE OF TEST:
CU with Pore Pressures

SAMPLE TYPE: undisturbed

DESCRIPTION: olive brown clayey SAND

ASSUMED SPECIFIC GRAVITY= 2.8

REMARKS: Strengths taken at the peak stress ratios.

Fig. No.: ______

CLIENT: Lowney

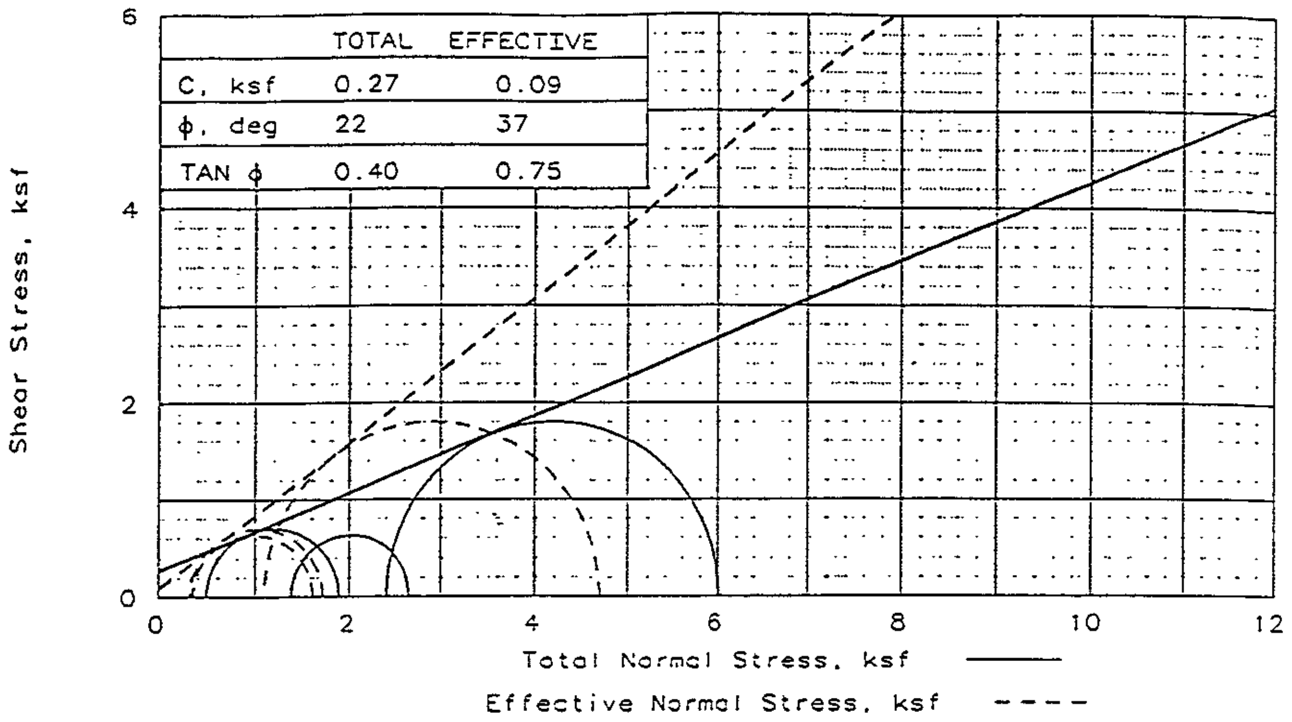
PROJECT: 1026-3C

SAMPLE LOCATION: EB-1 @ 17.5'

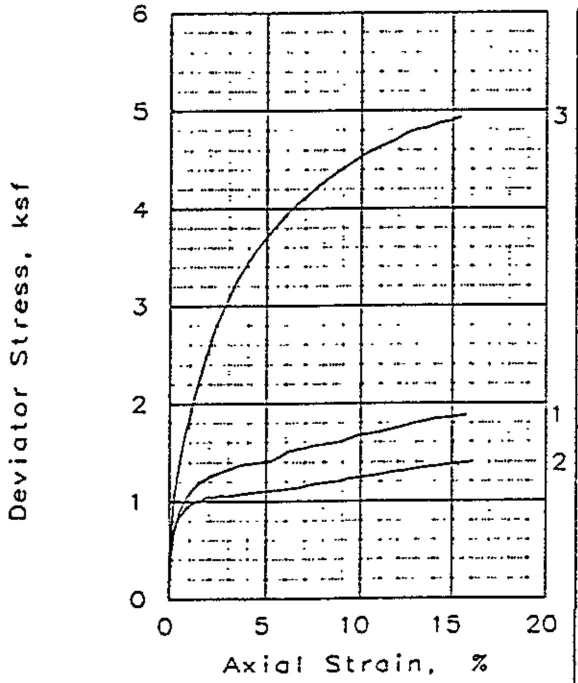
PROJ. NO.: 028-617 DATE: 3/25/99

TRIAXIAL SHEAR TEST REPORT

COOPER TESTING LABORATORY



	TOTAL	EFFECTIVE
C, ksf	0.27	0.09
ϕ, deg	22	37
TAN ϕ	0.40	0.75



	SAMPLE NO.:	1	2	3
INITIAL	WATER CONTENT, %	22.0	20.8	15.7
	DRY DENSITY, pcf	98.0	99.8	113.4
	SATURATION, %	82.7	81.3	87.0
	VOID RATIO	0.719	0.689	0.487
	DIAMETER, in	2.87	2.87	2.87
	HEIGHT, in	5.75	5.75	6.00
AT TEST	WATER CONTENT, %	23.6	23.5	17.3
	DRY DENSITY, pcf	103.0	103.1	114.9
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.637	0.635	0.467
	DIAMETER, in	2.81	2.85	2.87
	HEIGHT, in	5.72	5.66	5.90
	Strain rate, %/min	0.03	0.03	0.03
	EFF CELL PRESSURE, ksf	0.49	1.38	2.40
	Deviator Stress, ksf	1.40	1.27	3.60
	EXCESS PORE PR., ksf	0.17	1.04	1.31
	STRAIN, %	4.5	11.1	4.5
	ULT. STRESS, ksf			
	EXCESS PORE PR., ksf			
	STRAIN, %			
	$\bar{\sigma}_1$ FAILURE, ksf	1.72	1.61	4.70
	$\bar{\sigma}_3$ FAILURE, ksf	0.32	0.35	1.09

TYPE OF TEST:
CU with Pore Pressures
SAMPLE TYPE: undisturbed
DESCRIPTION: brown clayey SAND w/gravel

ASSUMED SPECIFIC GRAVITY= 2.7
REMARKS: The material varied slightly from sample to samp. Strengths taken at the peak stress ratios.
Fig. No.: ______

CLIENT: Lowney

PROJECT: 1026-3C

SAMPLE LOCATION: EB1-3 @ 5'

PROJ. NO.: 028-618 DATE: 3/26/99

TRIAXIAL SHEAR TEST REPORT

COOPER TESTING LABORATORY